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Simplification—What Does It Offer in the Machine Industry?

Diversification of Product Causes Many Needless Wastes—Organization in the Department of Commerce to Aid Simplification—How the Work of Simplification Is Conducted

By WILLIAM A. DURGIN
Department of Commerce

"WE ARE making altogether too many sizes. Week before last all our B automatics ran continuously on one size, and we got very attractive production cost. Last week, we had to alter the set-up on that same group nineteen times to make as many different sizes, and of course production cost went out of sight."

How many manufacturers have you heard say something of that sort these last few months? How many times have you said it yourself? And the jobber or retailer—any representative of the distributing group—will join the chorus with the refrain, "Yes, you are making altogether too many sizes; my shelves are loaded with thousands of items; my investment is extended way beyond my means, and the turnover is so small that I can't find the profits. Even so, I am carrying only part of the line I should have, for when customers come in for replacements or repairs, seems as though I always have to send somewhere to get them."

"That's right," says the user, the third and largest class, "if I invest in any kind of contraption which has to have repairs, or other maintenance, it is just my luck every time to get the one that is eternally different from everything else in town; I always have to wait days or weeks to get any spare part, and often I have to have something made special to fit."

All through the industrial structure this tale of over-diversification, the tremendous waste in making needless varieties, is beginning to be one of the commonplaces of shop talk. Bad enough under boom conditions with universally high demand and prosperous business, it becomes a vital weakness of our American business methods when the cataclysm of war wipes out the buying power of Europe, upsets economic balance throughout the world, and stretches the spread between raw material and finished product so tremendously that our American standard of living is imperiled.

Probably no man sees these conditions more clearly than Secretary Hoover, of the Department of Commerce. To him, elimination of the waste variously estimated at from 25 to 40 per cent of our total industrial effort, is a basic necessity if we are to reduce the spread between raw and finished products, maintain our American standards, and get our full share of world trade.

Prominent among his means for such waste elimination, is simplification, the concentration of effort on the comparatively few sizes of each line which really count in a large way, and the co-ordination of allied lines to secure maximum interchangeability. To carry this movement forward with as much force as possible, the Secretary has organized the "Division of Simplified Practice" of the Department of Commerce, offering the clearing house facilities and adding the moral weight which only a governmental department can give in the highest degree. To some, the Division of Simplified Practice appears the heir and executor of the Conservation Division of the War Industries Board, continuing those reductions of variety and simplifications of procedure which the stress of war made necessary, but which experience proved advantageous to all concerned. To others, the division is most clearly conceived as a liaison group between the Bureau of Standards and the industrial and business interests in carrying forward such standardizations as have direct bearing on waste elimination. While to still another group, it appeals as one of Secretary Hoover's most original contributions, through his conception of the Department of Commerce as the servant and representative of business and industry.

The truth combines all these interpretations and has perhaps a still more fundamental aspect. Excessive diversification was probably foredestined as an inevitable result of our first flounderings with the facilities which machinery, steam and electricity placed in our inexperienced hands. Similarly the corrective, simplification, is just as inevitable if we are to get the full value of these facilities for our daily living. With the

> SIMPLIFIED PRACTICE in any line will result in some or all of the following advantages:
>
> Reduction of stocks and investment, and increase in turnover.
>
> Lower costs to the public through mass production and the intelligent application of the repetitive process.
>
> Lower costs all along the line through quicker deliveries from simplified stocks.
>
> More stable employment by permitting the safe accumulation of standard lines of stock through slack periods.

production of automatic machinery and the release of tremendous stores of natural energy in the form of cheap power, it has been comparatively easy for almost anyone to become a manufacturer. The machines themselves supplied all the intelligence necessary to gain the benefits of the repetitive process and moderately low production costs. The factory once started almost ran itself and the attraction of manufacturing drew many men whose inspiration was profit rather than craftsmanship. Thus production plants have been multiplied, often with little basis of improved quality or design of product, much of the output being quite obviously as close a copy of successful lines as was legally possible. When it came to selling these closely similar lines, it proved easiest to make superficial changes in dimensions or finish that could be used by the selling force in their sales talk—and at once we were in a fair way to be swamped with varieties.

Long before the war we had begun to suffer from this saturnalia of diversification. Many of you will remember the remarkable popularity of Wagner's sermon-essay, "The Simple Life," which appeared at the beginning of the century. His objective, of course, was the simplification of daily living, but there is a very definite correlation with our present interest. Even in the prosperity preceding the World War, the extreme diversifications of product were imperiling our commercial stability, dilating the development of product by spreading attention over the unnecessarily wide lines, depreciating quality, and tremendously increasing costs.

Under present conditions, not only are these weaknesses intensified but the new diseases suggested above appear on every hand. Stocks and investment are needlessly extended. Turnover is decreased. Costs of production are run up in each of numberless varieties. Deliveries are delayed in getting the particular item ordered. It is unsafe to accumulate stock during slack periods, for no man can predict just what variety will be demanded when the boom appears. All the wastes attendant on indecision of production in use are prevalent. Selling expense is boosted to a maximum in covering the many varieties. Misunderstandings and misrepresentations are prevalent. There is little fundamental investigation and development of basic lines, as it is so much simpler to change trifling details and start a new variety.

With such conditions, it is little wonder that there is a real demand among manufacturers, distributors and users for reduced varieties, for agreement on certain fundamentals of dimensions and nomenclature which shall simplify and stabilize production, reduce costs and stimulate business. But admitting this demand, you say, and fully realizing the importance of prompt action, why does not the industry carry through itself—what service can Government offer which will be of fundamental importance? Just the service that democratic government can offer in all relations of organized life—the co-ordinating and making effective of the best practice and opinion of our people.

If manufacturers alone start a program of simplification, it is open immediately to suspicion of purely selfish interest; and similar suspicions apply to movements started by distributors, or by users. But if all groups are brought together through a conference of representatives of recognized standing in their respective fields, the joint conference can work out a compromise recommendation which will represent the best available solution of the existing problem. Then the Government can adopt this recommendation as its own and give it formal standing as the recommended practice of the country.

It is exactly along these lines that the Division of Simplified Practice is working. We make no pretense of detailed knowledge in any specific field. We can not say, for example, just the extent of the benefits simplification of machinery will bring to all those interested in its production, distribution and use. If any group in the machinery field, however, believes that the benefits are worth while, the division stands ready to get together all others interested in a general conference which can discuss the whole question and, if it proves desirable, arrive at a definite recommendation for procedure.

As an example of the very obvious advantages which will accrue to all of us from simplification in some lines, the conditions in the bedstead industry may be cited. At present manufacturers of metal beds have agreed upon certain standard dimensions of length and breadth. Manufacturers of wooden beds have also agreed upon their ideas of standards. Makers of metal spring mattresses attempt to conform to the standards established by the two groups of bed manufacturers. Makers of fabric mattresses also attempt to conform; but to date the standardization is largely on paper. The groups have gone ahead separately. Attempts at joint action have proved futile, and the so-called independent manufacturers, not allied with trade associations, have developed as many dimensions as their individual ideas have suggested. Often the chance dimensions of the raw material have fixed those of the finished structure. As a result, when you or I need a spring or mattress,

SOME OTHER advantages obtained by the use of Simplified Practice are:

A marked decrease of present selling expenses, which have been so much increased with tremendously extended varieties; this applying not only to the salesmen themselves, but to their equipment and catalogs and to the general office accounts.

A much better understanding between buyer and seller through their use of a definite vocabulary.

The concentration of thought and effort on the cream of each line, which must result in the best possible product.

Finally the bringing of our production into line for the genuine development of foreign commerce. England, Germany and other countries have vigorous national movements towards standardization which must be met if we are not only to hold our own in foreign markets, but make the notable advances which the war's disturbance of economic balance makes possible.

the dealer has to send a man to measure our bedstead and make something special, so that these industries proceed on a tailoring rather than a manufacturing basis.

The bed business needs the centralization and moral force which can be given by leadership of the Department of Commerce. This particular simplification is well under way, and in the near future the interested groups will unite in a general recommendation of the recognized length for all beds, and widths for double beds, twin beds, cots, and institutional beds, which can be promulgated as the simplified practice of the country. In arriving at these figures full weight will be given to development of the foreign market, and from the simplified recommendation we hope will result such a reduction in production costs, of stocks and selling costs, such an increase in turnover, that employment in the bedstead and allied industries will be stabilized, the business of individual manufacturers secured, and the cost to each of us in our own homes materially reduced.

Artistic License and Simplification

Please notice that in all this there is no question of the art design or finish of the bedstead. The artist is still fully at liberty. Surely he can create just as beautiful a Chippendale if he adheres to an internal length of 6 ft. 3 in., which will accommodate all of us, as if, on the spur of the moment, he adopts 5 ft. 11 in. and so imposes a double reversed curve on the occupant.

Beds are but an example; it is difficult to think of any commodity which the story doesn't fit. But in considering the almost limitless field, please remember, always, that the whole endeavor carefully avoids interference with art or style, and indeed just as carefully avoids interference of any sort.

Probably this example will suggest the necessary procedure to arrive at formal simplification. The first step is to arrange for securing statistics, or other data, which shall show present conditions and indicate the line for action. For the machinery interests, the representative trade associations would appoint a small contact committee to get in touch with Secretary Hoover and the Division of Simplified Practice. After a conference at Washington, this committee would proceed to survey the machinery field for the Department of Commerce, getting figures showing varieties manufactured and the importance of the several items during the last few years. The committee would summarize these data in a report covering present conditions, and would then forward the summary to the Division of Simplified Practice. With this report before it, the division would prepare a tentative list of representatives to the general conference—the personnel of the list being submitted to all trade associations interested, and to the United States Chamber of Commerce, the American Engineering Standards Committee, and other bodies, to insure that every factor in the field was given proper voice. All the representatives included in the final amplified list would then be invited to a conference in Washington, and this conference would proceed to work out such recommendations for simplification as the general discussion should develop. The conference would further decide how frequently similar conferences for revision of the recommendations should be called, and each representative would engage to obtain the approval of his association, firm, or other parent body, to the recommendations as finally adopted. Finally, the Division of Simplified Practice, for the Government, would give national standing and publicity to the action of the conference by issuing the recommendation as one of its official series. This series will be numbered in sequence and will be known as "Simplified Practice Recommendations of the Department of Commerce." As a part of its service the division will obtain a formal letter of acceptance of the recommendation from each of the bodies represented at the conference, and, when necessary, from the individual members of those associations most interested. At regular intervals, statistics from all manufacturers and distributors as to the percentage of business done in the simplified sizes will be requested, and the division will accumulate data on necessary revisions, calling the conferences for such revision at the times originally set by the industry.

Simplifications of Allied Lines Necessary

With movements of this sort now going forward in many industries, it is essential that the simplifications of allied lines properly fit together. Obviously simplification of machinery is very closely allied to simplification of brass and steel shapes and sizes; similarly, simplification of wooden bedsteads is closely related to that of lumber, and so on. Thus there is an additional reason for co-ordinating these movements through a government division.

This function of co-ordination can not be too strongly emphasized. There is no question of imposing simplification, the division being intended simply to function as as centralizing unit for those simplifications of dimensions and nomenclature already demanded by manufacturer, distributor or user. If, in the judgment of any industry, simplification is not suitable to its problem, it need fear no interference, but it had best look to its economic stability as threatened by overdiversification. The benefits of simplification are already so evident to a wide range of industries that the general movement is certain to go forward of its own momentum, and the Division of Simplified Practice hopes to aid in lasting elimination of waste.

Automotive Service Methods and Equipment

IX. Some Unique Service Tools—"Roll Your Own" Fenders—Making Bronze Bushings in the Machine Shop—A Home-made Running-in Stand

By HOWARD CAMPBELL
Western Editor, American Machinist

WITH the passing of the stage coach and the development of more efficient methods of transportation, the reputation of the express companies for "delivering the goods" has been enchanced by the use of transportation units of the most modern type. The Chicago division of the American Express Co. operates a fleet of motor trucks among which are included both gasoline and electric units, and the equipment for servicing these units includes some pieces that will be interesting to other service managers.

A piece of home-made equipment known as a "spring vise" is shown in Fig. 1. This vise is used for holding springs when it becomes necessary to separate the leaves of the spring for the purpose of cleaning, for replacing broken leaves with new ones, or for putting in new center bolts.

The side frames *A* are made of ¾-in. angle steel, and the flat pieces across the bottom of the vise are of ¾-in. flat steel. The other sections of angle steel are ¼ in. thick. Some of these sections are riveted so as to form ways as shown at *B*, and steel blocks are welded to the crosspiece of the movable vise jaw as can be

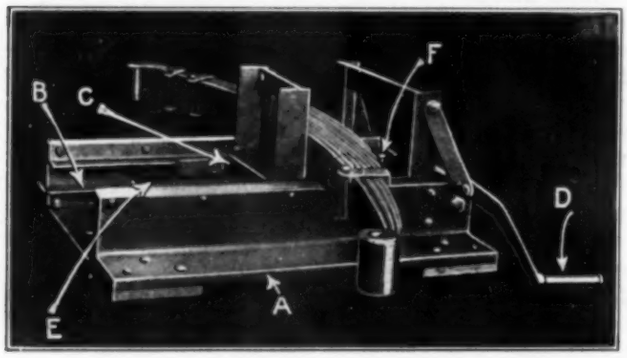


FIG. 1. A HANDY SPRING VISE

seen at *C*, so that the jaw will function properly when the handle *D* is turned.

The operation of this handle turns the screw *E*, which operates through a nut in the movable vise jaw, feeding the jaw in the direction desired. A solid collar is turned on the handle end of this screw, and a movable collar, held by the screw *F*, holds the screw in place while in operation. The feed screw is ¾ in. in diameter, 10 threads to the inch, and works very well.

Making Controller Segments

A fixture for bending copper segments for controllers on electric trucks is shown in Fig. 2. The copper bar from which the segments are made is ⅜ x ¾ in. The controller segments are from 1 in. to 7 or 8 in. in length, some nearly circling the controller. The tool consists of a round piece of steel *A*, turned to the correct diameter, to which the piece *B* is attached by two bolts and nuts, and the piece *C*, which turns on the pin *D*. The piece *C* is of ¾ x 2-in. stock, and a small piece *E* is attached by a small bolt as shown, to take the wear, and also so that the tool can be used for different thicknesses of stock.

In operation, one end of the copper bar is clamped to the tool by means of the clamp *B*, then the bar *C*

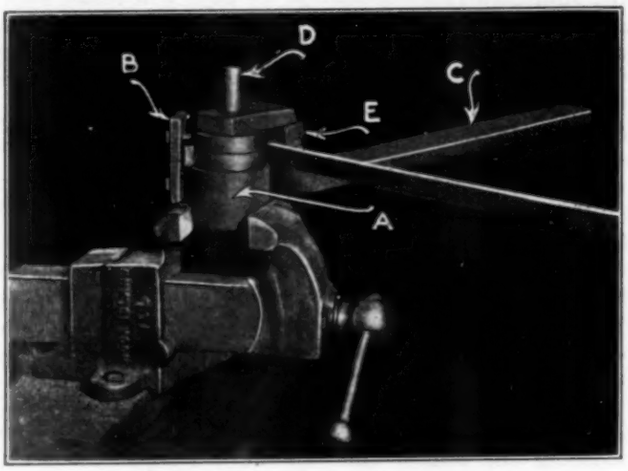


FIG 2. SEGMENT-BENDING TOOL

is pulled around, bending the copper bar to shape. The segments are then cut off to the desired length, after which they are laid out and drilled. After the segments are attached to the controller, the controller is put into a lathe and the outside is turned to size.

Home-made Truck Fenders

A method of making fenders for trucks is shown in Fig. 3. In actual operation, a truck is used for the job, but as no truck was available at the time the picture was taken, a wheel was used to demonstrate the operation of the tool.

Occasionally a fender has to be replaced, and the

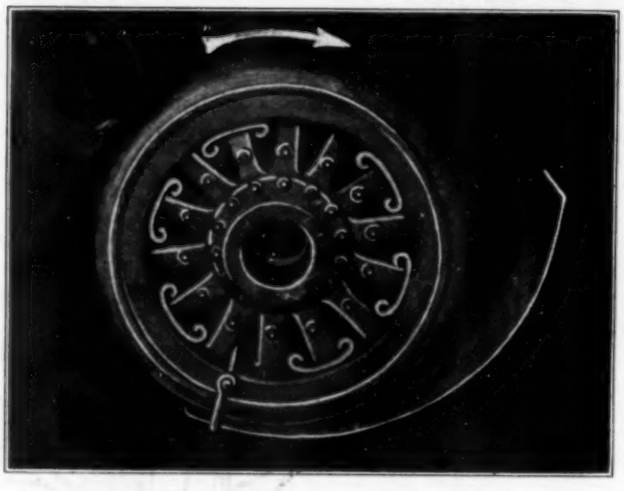


FIG. 3. MAKING A TRUCK FENDER

Express Company has found that time and money can be saved by making its own, and that the home-made ones are just as serviceable. The material for the fender is a piece of ⅜-in. sheet steel, 12 in. wide and

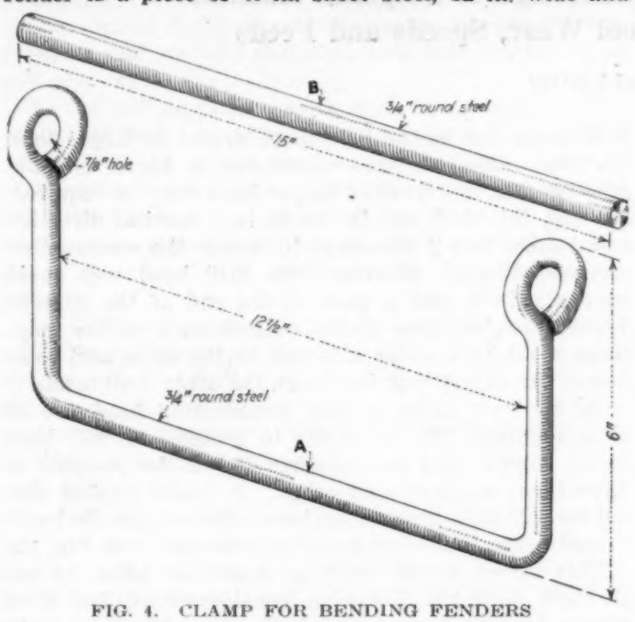


FIG. 4. CLAMP FOR BENDING FENDERS

4 ft. long. The tool is made of ¾-in. round steel, bent as shown in Fig. 4. In operation, the piece marked *A* is put in place around the tire of the wheel, and the piece *B* is slipped through the eyes. Then one end of the piece from which the fender is to be made is slipped through the U-bolt, as shown. The fender is bent to shape by running the truck slowly forward in the direction of the arrow.

The Modern "Putting-on" Tool

A view of an operator using a "putting-on" tool is shown in Fig. 5, the job being that of welding metal on to a worn out torque shaft. This is done when a shaft

FIG. 5. A "PUTTING-ON" TOOL WELDING METAL ON A WORN OUT TORQUE SHAFT

becomes badly worn in one spot, and then the shaft is re-machined. The apparatus is an ordinary acetylene-welding outfit, and the operator is using an Imperial welding torch. By this means many pieces that would otherwise be scrapped are saved and used almost indefinitely at small cost.

An interesting operation with the welding torch is that of welding bronze into clevis holes. Fig. 6 shows a couple of clevises that have been welded in this manner. The faces are now disk-ground to give a smooth bearing surface, then the holes are laid out and drilled and reamed. This method of making bronze bushings is cheap and the bushings are durable.

The Running-in Stand

A home-made running-in stand is seen in Fig. 7. It consists of a motor stand, part of which is shown at the left of the picture, and a rack to which is bolted an old transmission. The motor and the transmission are connected by a universal shaft, and the whole outfit is run by power transmitted from the line shaft through a belt and pulley to the shaft at the right in the picture, which connects with the drive and countershafts in the transmission.

The motor stand is not bolted to the floor, as it has

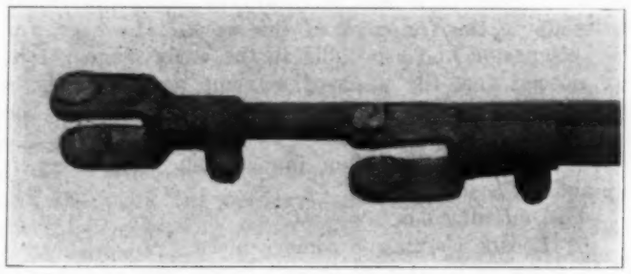


FIG. 6. BRONZE WELDED INTO CLEVIS HOLES FOR BUSHINGS

to be shifted to accomodate the different kinds of motors. The motor end of the universal shaft is made so that any one of a variety of adapters can be used, ac-

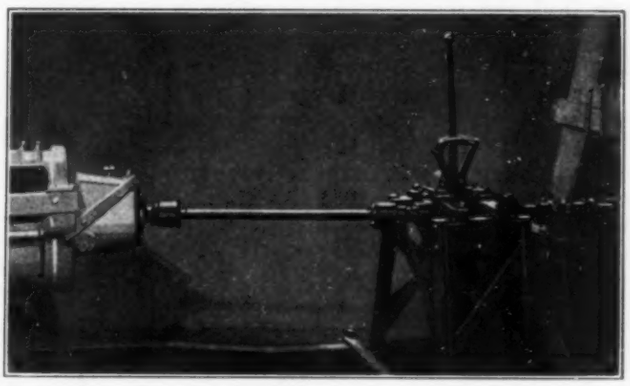


FIG. 7. A HOME-MADE RUNNING-IN STAND

cording to the make of motor, and the transmission makes it possible to run the motor in at all the various speeds for which it is built. The shaft by which the transmission is driven is a section of line shaft, running in an ordinary line shaft bearing. The stands to which the transmission and bearing are bolted are made of sections of ¼-in. angle steel, bolted together. This outfit can be easily built anywhere, and is thoroughly efficient for the job.

The appliances shown indicate very plainly how the repair shop is growing to deserve the name "service station" more and more.

Methods of Machine Tool Design

Concluding the Second Article on the Design of a Special Machine—Effect of Considerations of Tool Wear, Speeds and Feeds

BY A. L. DELEEUW

SO far none of the things we have done clash with the original schedule we had laid out, but this latest change does, for our schedule item No. 2 says clearly, "mill top and pass cutter completely over work, bringing the cutter slide against a stop."

In order to meet the new conditions we will have to change the schedule as follows:

(1) Chuck piece.

(2) Mill top, bringing cutter so far that its center will come above the far edge. (The center of the cutter should be over the far edge of the work or a little further *if* the cutter has the same diameter as the width of the work which, by the way, is never desirable. In our case the cutter is ½ in. larger than the width of the work, so that it is not necessary to bring the cutter quite up to the far edge of the work. However, for our discussion and especially in the early stages of it, we do not feel the need of extreme accuracy. It is the process which is being presented and not the actual design of a machine.)

(3) Return cutter slide immediately and bring it up against a stop.

(4) Drill all holes.

(5) Loosen clamp and remove piece.

In order to be able to form a rough idea of the construction of the combination slide we make the sketch of Fig. 10, which shows the machine as far as we have it up to the present. It shows some of the features of the combination head, but not all of them. The milling cutter is shown, and the drill spindle is indicated, and it shows further a slideway along which the head can feed, and the stop against which it is to come to rest. We will now investigate what further features this head requires to make it function properly.

There must be a milling spindle with its drive, and this spindle must be adjustable in a vertical direction so as to make up for variations in the cutter. The amount of adjustment will be very small because only a small amount can be taken off the teeth of the cutter before it becomes useless. Probably ¼ in. would be enough, but as it is about as easy to make an adjustment of ¾ in. as of ¼ in. we will say, for the present, that we will provide for an adjustment of ¾ in. The drill head will be of a construction similar to the other drill heads but as the hole to be drilled is larger than the other holes we have considered so far it is quite possible that a somewhat larger head may be required. Besides, this drill spindle works in a vertical direction and we may find it necessary to change the construction correspondingly. However, the drill head will again have a spindle and a gear at the end of the spindle. There must be a long pinion, or perhaps a sliding gear, there must be a roller attached to the slide, and some means for adjustment just as in the other drill heads.

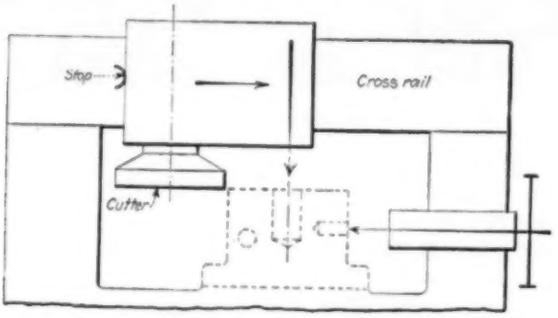


FIG. 10. PROGRESS SKETCH OF MACHINE AS OUTLINED

As the two units of this combination head are so close together (3¾ in. center to center) we will have to be careful and see whether it will be possible to have them so near each other. In order to find this out we will make a cross-section of the two spindle heads to make sure that there is no interference. See Fig. 11.

This sketch would really be drawn up after we are through with the following considerations, but it is shown here at this stage of the game so as to make the description of our process of reasoning easier.

We estimate the milling spindle to be 2 in. in diameter at the large end, to run in a bushing ¼ in. thick and to require not less than ¾ in. metal around the bushing.

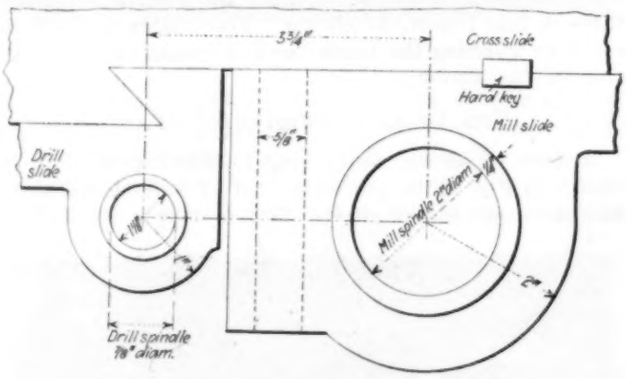


FIG. 11. SCALE DRAWING OF PARTS OF MILLING AND DRILLING HEAD

We would not be willing to get along with less. Similarly we estimate the drill spindle to be ⅞ in. in diameter, to run in a bushing ⅛ in. thick and to have not less than 7/16 in. metal around it. Doing this we have taken up 3 in. out of 3¾ in. available. Making a preliminary sketch of these figures we notice that we can increase the metal anywhere except on the side where the two heads approach each other.

The milling head has no feed up and down and only a small amount of adjustment. Not being required to feed, we need no slide and can guide the head by a key and keyway; and, the amount of adjustment being small, we can readily accomplish it by having slotted holes for the clamping bolts.

The drill head, on the other hand, requires feed and adjustment so that we will need a slide bearing. These elements are shown in Fig. 11.

As it stands now the milling head can be adjusted

up and down a small amount, it does not interfere with the drill head, and we can give as much metal around both spindles as we wish, being limited only on one side.

Another point where we may expect some trouble is in the drives for the two spindles which are so close together and we will therefore take this matter up as our next step.

As the milling cutter has to work on a rough casting, we should limit the cutting speed to about 70 ft., which means that the spindle must run 107 r.p.m. The drill spindle should run at the highest practical speed, because the time required for the second operation, the drilling of the holes, depends entirely on the time used by this drill; the other drills being smaller and drilling less deeply.

We should therefore run the drill as fast as practical and give it the coarsest practical feed. However, this being an automatic machine in which a number of tools are at work, it is not wise to go with feed and speeds as far as we might go with a hand-controlled machine in which only one tool works at a time, for the delays caused by the breaking down of a single tool are of more importance in this class of machinery. We will, therefore, limit our speed to 100 ft. per minute and our feed to 0.006 in. per revolution. This brings the speed up to 770 r.p.m. Having two spindles so close together it is but natural that we should think of driving both from one common source. Calling the drill spindle *A*, the milling spindle *B* and the common driving source *C*, the question is this: Shall we drive *A* from *C*, and *B* from *A*, or *B* from *C*, and *A* from *B*, or shall we drive both *B* and *A* from *C*?

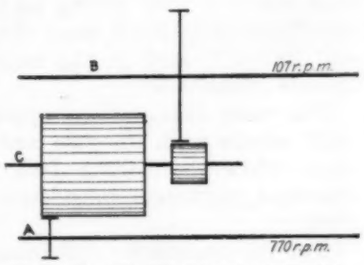


FIG. 12. SHORTHAND SKETCH OF DRIVE

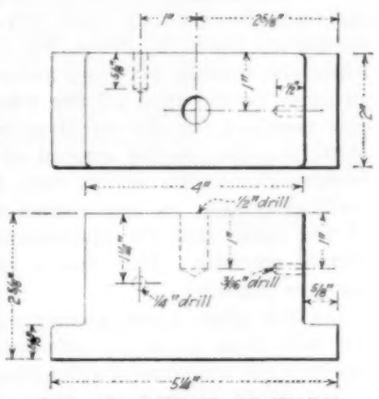


FIG. 13. DETAIL OF WORK

If we follow the first scheme we will have a reduction of about 7½ to 1 between *A* and *B* which is a greater reduction than can be accomplished by one set of gears. If we follow the second scheme, we would have to speed up in ratio of about 7½ to 1 which is entirely undesirable; so that it looks quite natural that, with the given proportion of speeds, we should follow the third scheme. Fig. 12 shows this arrangement sketched out in shorthand. With this arrangement *A* runs 770 r.p.m., *B* 107 r.p.m., and the question is, what will be a good speed for shaft *C*?

The range in speeds is $\frac{770}{107} = 7.2$. As a first possible arrangement we will give shaft *C* a speed of 320 r.p.m., which will give a speeding up from *C* to *A* in ratio of 2.4 to 1, and a slowing down toward *B* of 3 to 1. We may find later that it is desirable to change this speed somewhat, but the speed selected does not require a very large gear on *B* nor does it speed up much toward *A*, while it gives a very moderate shaft speed for *C*.

We now check up this driving arrangement to see if perhaps we have introduced an undesirable element. As no dimension or location has been decided upon and as we are satisfied with the speed for the time being, there is only one thing that can be wrong—the direction. Of course, we can make *A* run in either direction by giving the proper direction to shaft *C*, but we notice that *A* and *B* would necessarily run in the same direction. Is this right?

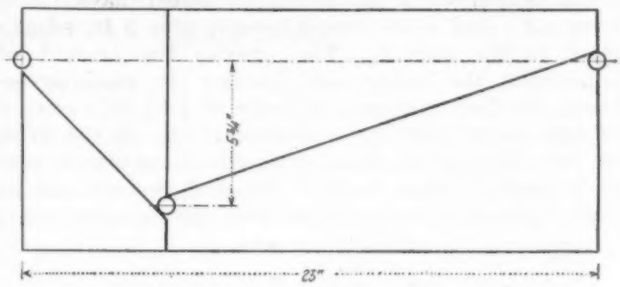


FIG. 14. MILLING HEAD OPERATING CAM

Looking at Fig. 9 we find that, if the milling spindle runs in a right-hand direction, the cutter will force the work against the stop, which is desirable. We will therefore make the milling cutter run in the right-hand direction which is the same as that for the drill spindle, and therefore the arrangement shown in Fig. 12 is correct in regard to directions.

We cannot very well go further with this arrangement of the drive without determining at the same time the sizes of gears, etc., which many be required, and it is still too early to determine detail sizes for them. As a rule detail sizes should not be determined until we have a complete preliminary idea of the entire machine, and this we have not yet. We said "as a rule" because now and then we will find an exception. If, for instance, we have to design a machine which must do extremely heavy work, then it may well be that the last element of the drive, for instance, the spindle or the last driving gear, is the controlling factor for our considerations. In such a case we should start out with an analysis of that drive, beginning with the heaviest member. But as a rule this condition does not present itself and the drive alone is merely one of the many functions of the machine, all of which should get due consideration before we analyze any of the details. For this reason we will go on to the next item of our general construction, namely the feed.

In Fig. 13 are shown the dimensions of the piece of work. It shows that the length to be milled is 4 in., as we already know; it further shows that the deepest hole to be drilled is 1 in. in depth, so that the distance which the drill spindle must feed is a little less than 1⅛ in. That is to say, if the drill point should touch the finished surface of the work it would have to go down 1⅛ in. to complete the hole. However, if we look at Fig. 9 and at our revised schedule we will see that the drill is over the rough surface of the work while the milling takes place. The amount of finish allowed on the piece is probably ⅛ in., but might be a little more in spots; so that we ought to allow not less than ¼ in. Besides, the drill point is not supposed to touch this surface; it should be a small distance above the work. We will therefore allow for a total amount

of feed for the drill spindle 1½ in. As to adjustment, we reason this way:

It would be possible to grind a ½-in. drill down for a length of 3 in. before it would have to be scrapped. And so we would have to give 3 in. adjustment to the spindle. The greater the amount of adjustment the larger and clumsier the machine becomes, so that it is very desirable to keep this amount of adjustment down to a minimum. As all the drills we are using are standard sizes, which are always sure to be used in other parts of the shop, we will use up these drills only part way and then use them elsewhere

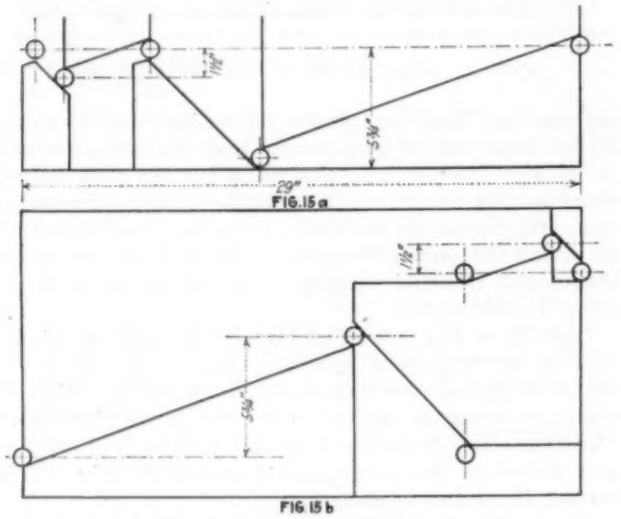


FIG. 15. TWO POSSIBLE ARRANGEMENTS OF CAMS FOR MILLING AND DRILLING

in the shop for some other purpose; and so we decide arbitrarily to limit the adjustment of the drill spindle to 1 inch.

We found that the amount of feed required for the combination head is 5¾ in. and the question is now: In what way shall be provide this feed and how shall we provide the necessary feed for the vertical drill spindle?

Here, again, we have the same condition we found with the horizontal drill spindle, namely, that we always have to feed the same amount and always at the same rate, so that a cam would meet our conditions very well. Besides, the fact that we have already decided to use cams for the horizontal drill spindles makes it probable that at least a part of the feed arrangements for these spindles can also be used for the vertical drill spindle and the milling spindle. Following our system of taking up only one thing at a time, we will first consider the conditions of the cam to be used for the milling spindle.

The amount of feed is 5¾ in. and so is the amount of return. There is no rapid advance. If we should use a drum cam for this feed and make the slope for the strip which does the feeding 1 in 3 and the return cam with an angle of 45 deg., we would obtain a cam represented by Fig. 14. We would find that the circumference of this cam, measured on the pitch line, would be about 23 in.; and its diameter about 7⅜ in. After this cam has done its work the cams for the various drill spindles must begin to act and we are confronted with the question: Shall we make the milling cam stop while the drill cams do their work, or shall we let all cams run continually?

If we should follow the second plan, the milling cam must have the same diameter as if it were first feeding the milling spindle and then the drill spindle; in other words, as if a second cam for the drill feed were added to our diagram of Fig. 14. Two arrangements are shown in Fig. 15; and we would find that in either case the pitch diameter of the cam would have to be 9¼ in. This would make a very simple construction provided, of course, that it would be possible to use this cam for the drill feed; and before we can make a decision we must look into this matter and see if it is possible to make a construction which will permit of the use of one and the same cam for milling and vertical drilling.

If we should imagine that we have carried out this plan, then the cam used for this purpose must do the following: It must first feed the milling spindle 5¾ in., then return it and, during all this time, keep the drill spindle immovable; it must then feed the drill spindle and return it and, in the meantime, keep the milling spindle immovable.

The main difficulty we would meet here is that the drill spindle with its slide and roller must move sideways while the milling feed goes on, and yet this sideways movement must have no effect on the drill feed.

For the present we will imagine that we have found a proper solution for this problem which, by the way, will be taken up in a later chapter. Having solved this problem, the question still remains whether it is advisable to have the cams for the drilling stand still while the milling goes on, and vice versa, or whether all cams should turn all the time. We found that the cam required for the combination slide has a diameter of 9¼ in., and, as the amount of feed required for the horizontal spindles is but very little less than for the vertical spindle, we may expect that we will need cams of the same size (or approximately so), for the horizontal spindles. This means three rather large cams for this machine.

On the other hand, should we follow the first plan, we will have quite a complicated system of control because the schedule of operations would be as follows:

(1) Milling cam turns, causing feed and return, then stops; for which purpose a trip must be operated by this cam itself or by something running in unison with it.

(2) This same trip starts the drill cams which make one complete revolution for feed and return, at the end of which they trip themselves out of action and not only that, but they must also trip the entire feed mechanism out of action, so as to give the operator a chance to chuck a new piece.

We will leave the solution of this problem, also, to a later chapter when we will be able to judge better as to which is the preferable method under these or other circumstances.

We can readily see that it will not be possible to make much further headway with our machine unless we now begin to sketch out some of the items in greater detail. And before we do that, we will make a study of the various functions and mechanisms which are commonly used in the construction of machine tools. When we have analyzed some of the detail constructions, we will return to our original schedule and sketches and make them more and more complete, remembering that they are the most important documents we have, as they represent the succession of steps in our process of reasoning.

Use of Optical Instruments in Machine Work

Microscope and Projector Used to Check Location and Contour of Work—Accurate Gear and Rack Cutting—An Eyepiece With Radial Lines

SPECIAL CORRESPONDENCE

ALTHOUGH the ordinary magnifying glass is perhaps the most common optical tool in universal use in the country today, the mechanical trades in general have not taken advantage of the possibilities of the more extended application of optics to their work. When we stop to consider the enormous advantages of using a light beam with its absolute rigidity, lack of

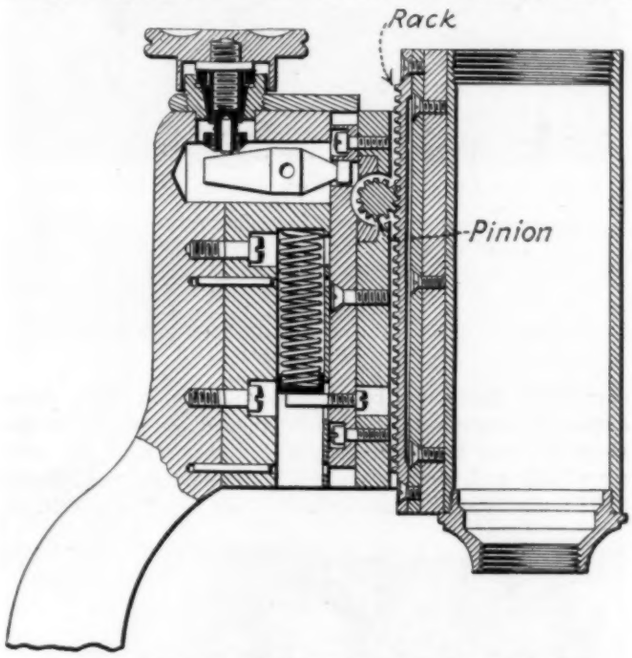


FIG. 1. ASSEMBLY SHOWING RACK AND PINION.

inertia, friction and mechanical defects, as a multiplying lever; and combining with it as a unit of measure, the light wave with its unfailing constancy of length, we must conclude that we have ideal agents to help us bring about that most desirable aid to manufacturing, economical interchangeability.

During the last half century the Bausch & Lomb Optical Co., Rochester, N. Y., has studied this problem thoroughly and today is using many applications which will no doubt be of much interest to industry as a whole.

The small spiral racks and pinions used in the focusing mechanism and mechanical stages of precision microscopes have always been a bugbear to the mechanics engaged on this work. The requirements are very exacting, as a degree of interchangeability is demanded that will permit of an assembly showing no visible vibration of the greatly enlarged image when focusing the microscope equipped with its most powerful objective lenses. Fig. 1 is an assembly showing the culprits in the focusing mechanism. The rolling action should be perfect, which means that the form of tooth and spacing must be maintained to a high degree of accuracy; the pitch diameter of the pinion and the depth of cut in both pinion and rack must also be held very close so that the slides can be milled to standard dimensions and assembled without fitting; the tooth cut must be smooth so that no inequalities can be felt as the rack rolls on the pinion; and last but not least the angle of spiral must be correct so that when secured in place the bearing will come over the entire length of the teeth.

The circular master tool used for forming the pinion cutters is shown in cross-section in Fig. 2. That used for rack cutters is similar in construction. The first difficult step in the problem was to find a steel, heat-treatment and cutting lubricant that would enable the tool to hold a keen cutting edge long enough to form and back off a cutter with a smooth polished surface. Not only was it necessary to have the tool hold its edge, but its properties were required to be such that the fine chips formed when in action would not pile up and adhere to the edge sufficiently to scratch the surface of the cutter. The only way found to solve this part of the problem was to make up a large number of plain circular forming tools of the different steels to be tested, and turn off a definite amount of stock from standard cutter blanks with them, then examine their edges under a high power microscope and measure with a filar micrometer-eyepiece the extent of wear and the amount of material adhering.

By varying these tests, using different heat-treatments of both the forming tool and blanks, different steels for the blanks, and trying various lubricants, the proper conditions were found that would give most nearly ideal results. It was found that under the best conditions, no forming tool could be made that would wear less than 0.0002 in. during a test representing the work necessary to finish a cutter.

In Fig. 3 is shown the appearance of the edge of the cutter finally used at 50x magnification. Fig. 4 shows a 1,000x microphotograph taken of the etched cutter as an aid in reproducing the exact conditions in cutters to be made later.

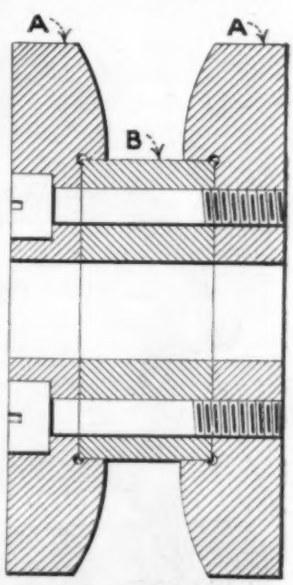


FIG. 2. SECTION OF CIRCULAR MASTER TOOL

In the construction of the master tool, the component parts are roughed out, heat-treated and ground on all surfaces. The formed surfaces of the side plates A are lapped on an epicycloidal generating machine, their contours being examined under high magnification on the contour projector shown in Fig. 5.

This projection apparatus and screen are self contained and use a compound microscope (in place of the ordinary projection lens) and a prism to reflect the light beam at a right-angle so as to obtain the maximum distance on a small instrument,

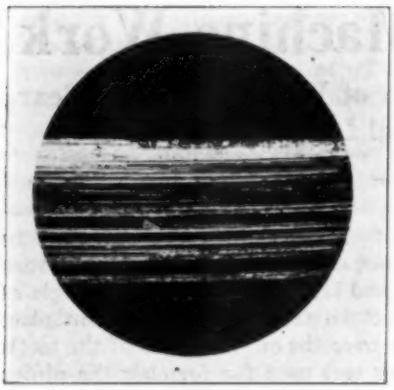


FIG. 3. MICROPHOTOGRAPH OF CUTTER EDGE AT 50x MAGNIFICATION

from the object to the screen. In Fig. 6 is shown a layout of the optical system used. The illuminant *A* is a 6-volt Mazda lamp, current for which is supplied through a 110-volt a.c. transformer. The condenser *B* is of aspheric form and when used in connection with the supplementary condenser *C*, gives as near parallel rays of light as possible. The iris diaphragm *D* allows the rays to be cut down to as small

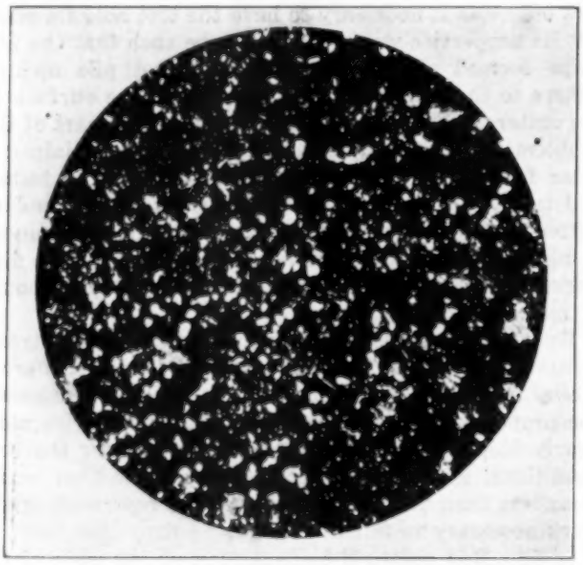


FIG. 4. MICROPHOTOGRAPH OF ETCHED CUTTER AT 1,000x MAGNIFICATION

a beam as may be desired. The rays pass through the object *E* (in the figure shown, a screw thread) into the objective lens *F* of a compound microscope. Beyond

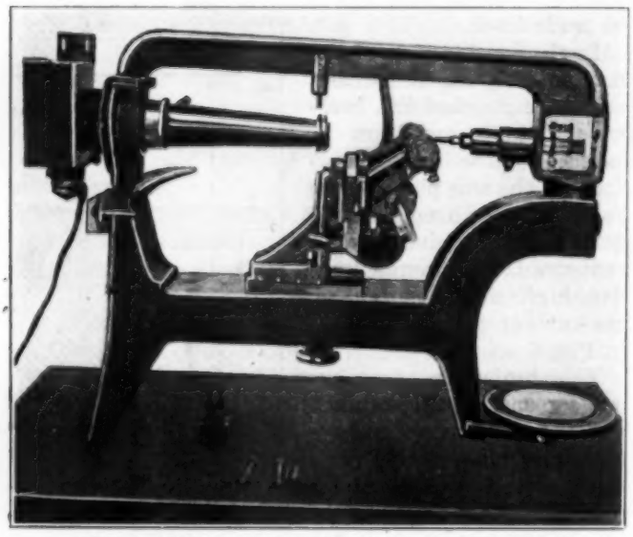


FIG. 5. CONTOUR PROJECTING APPARATUS

the eyepiece *G* is a right-angle prism *H* which reflects the light down upon the screen and forms the enlarged image *I*. It will be noted that the optical system is fixed and that focusing is brought about by moving the object back and forth on its side.

This apparatus was rigged up for shop use to overcome the disadvantages of the usual form requiring a

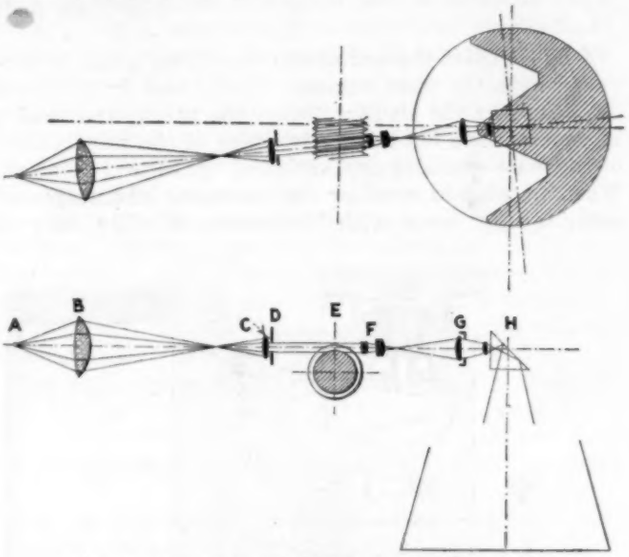


FIG. 6. OPTICAL SYSTEM OF THE CONTOUR PROJECTING APPARATUS

somewhat darkened room and a location free from excessive vibration. It can be placed anywhere in the shop and can be handled by one man without his running back and forth from the instrument to the screen.

The plates of the master tool, *A* in Fig. 2, are held on

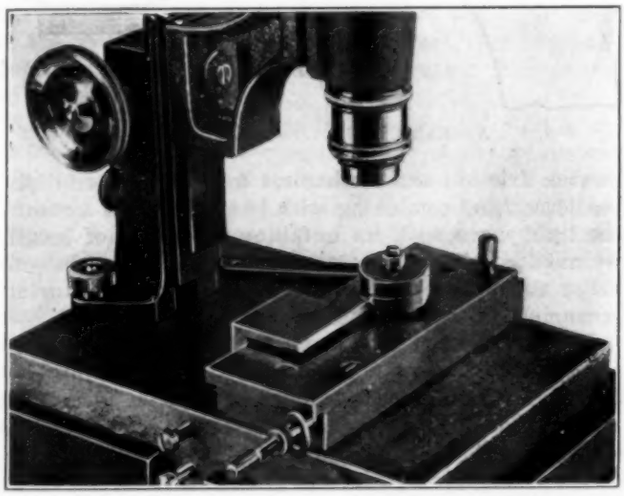


FIG. 7. GAGE FOR CHECKING THE MASTER TOOL

an arbor between centers and the image is projected against a master outline with which it must coincide. This is done at a magnification of 100x which makes certain of an exceedingly accurate tool if no visible error is apparent. The spacing block *B* being ground and lapped to proper thickness, the whole tool is assembled and the cutting edge sharpened to 0.180 in. below the center to give proper clearance. As a variation of shape at this particular section will deform the shape of the cutter, the operation is checked on the gage shown in Fig. 7. This gage consists of a stud over which the tool is held and a stop against which the

cutting edge is brought. A microscope with a straight line etched in its eyepiece is so mounted that the line represents the position of the cutting edge of the tool

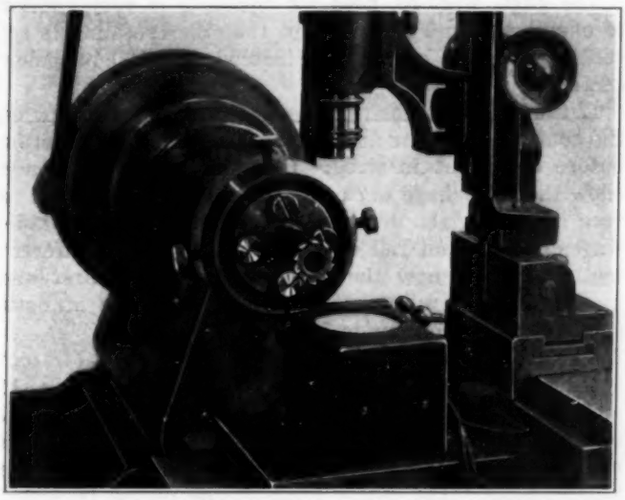


FIG. 8. CUTTER MOUNTED FOR GRINDING THE HOLE

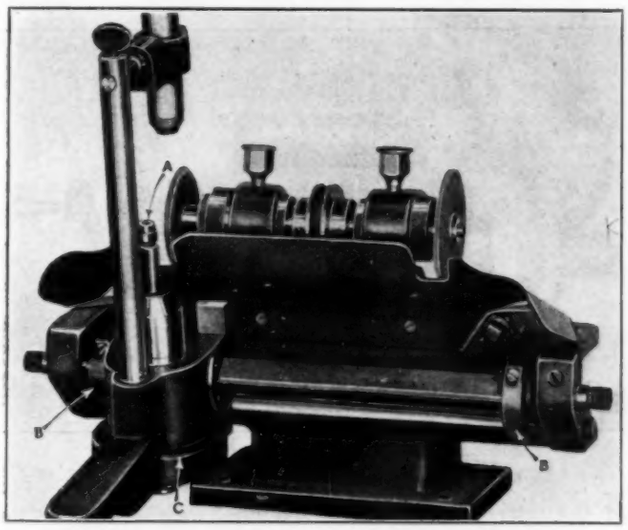


FIG. 9. MACHINE FOR GRINDING CUTTERS

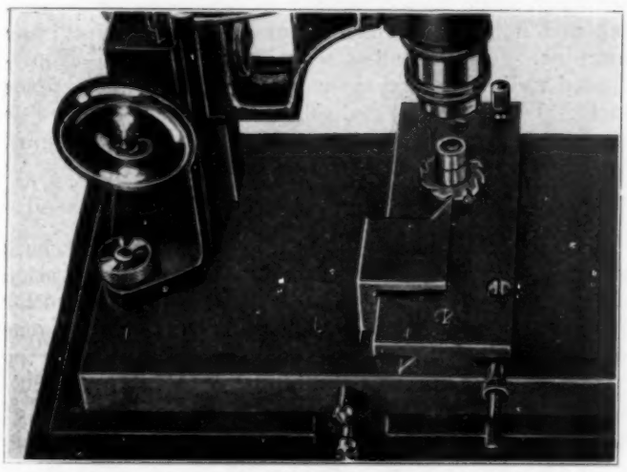


FIG. 10. GAGE FOR CHECKING RADIAL-GRINDING OF CUTTER

when properly sharpened. After this inspection, the tool is given a final examination on the contour projector, this time the instrument being focused on the cutting edge which will give an image shaped slightly different from the first inspection, due to the sharpening below the center. If the image coincides with the master on the screen, the tool is correct for forming and backing off the cutters.

The cutters are roughed all over and heat-treated and then a finish-forming and backing-off operation performed on a special backing-off machine. After this they are inspected for form, the same as described for the forming tool, and if found satisfactory are hardened and tempered. Notwithstanding the great care exercised both in the selection of steel and in the heat-treat-

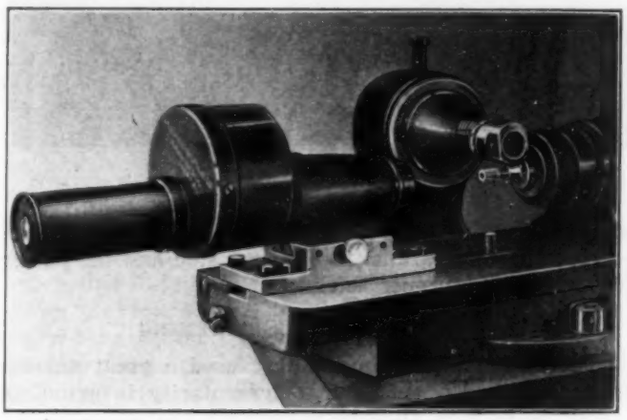


FIG. 11. OLD TYPE OF PINION CUTTING MACHINE

ment, distortion takes place to some extent and as no way has yet been found for lapping small relieved cutters of this kind, the errors of hardening must be eliminated in some other way.

The answer to this problem is shown in Fig. 8. The

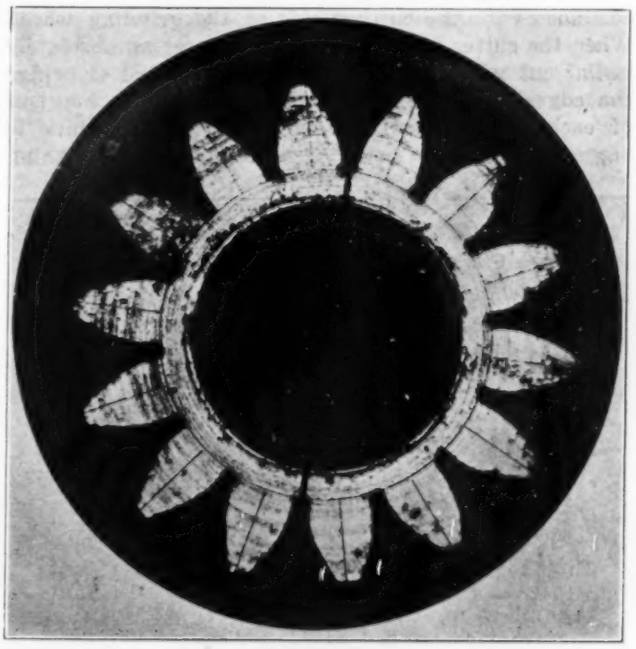


FIG. 12. PINION AS SEEN BY MICROSCOPE

cutter is fastened to an adjustable chuck by means of sealing wax and "wiggled up," while being observed under a microscope, until the teeth run true. The hole is then ground to size and one side of the cutter faced off to a fixed distance from the center line of the teeth. This distance is measured with the filar micrometer

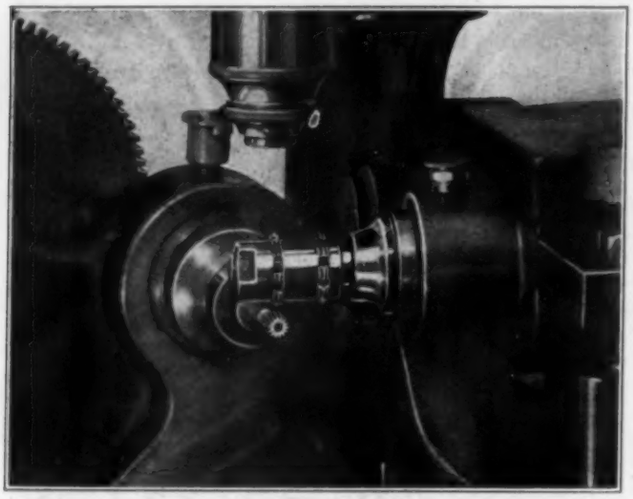


FIG. 13. LATE TYPE OF PINION CUTTING MACHINE

eyepiece on the microscope. The opposite face is then surface ground parallel to the first side and the cutter brought to the proper thickness.

The Problem of Sharpening

The operation of sharpening caused a great amount of trouble in the past due to irregularity in grinding, resulting in high and low teeth with the consequential roughness of cut. The problem was studied in the same light as in the previous operations and solved by the special machine shown in Fig. 9 and the gage shown in Fig. 10. In the machine a microscope is mounted on the arm carrying the index head in line with the center of stud *A* that holds the cutter to be sharpened. The stop *B* is adjusted so that the crossline in the eyepiece coincides with the cutting side of the grinding wheel. When the cutter is sharpened this insures an absolutely radial cut while the index under the guard *C* brings the edges into constant relation with the backing off of each tooth. It will be noted that the machine is rigged up with two grinding wheels, one for roughing and one for finishing. The settings for both wheels are made in the same way with the arm resting against the corresponding stop.

The gage, Fig. 10, used for checking is very similar to one shown in Fig. 7, except that the crossline is set central with the cutter hole instead of 0.100 in. below center.

If the cutter passes this inspection it is again put on the contour projector and given a thorough examination before being put in stock. This final inspection must show that the shape is correct and in proper relation to face of cutter, the diameter correct, no "wobble" sideways, no rise and fall of the cutting edge of different teeth. Having now the proper cutters, the first and most difficult requirement in the manufacture of first-class racks and pinions is fulfilled.

The cutting of the pinions is done on two different types of machines, the older type is shown in Fig. 11 and the more recent one in Fig. 13. In the type of machine shown in Fig. 11 the pinion is roughed on one machine and transferred to a similar machine for the finishing cut. The cutter head can be moved back and forth to bring the center of cutter under the crossline

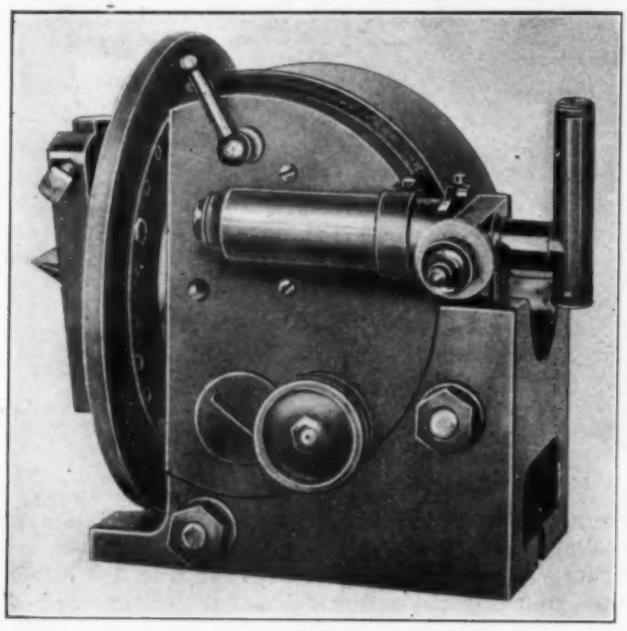


FIG. 14. DIVIDING HEAD FOR CUTTING ACCURATE INDEX PLATE

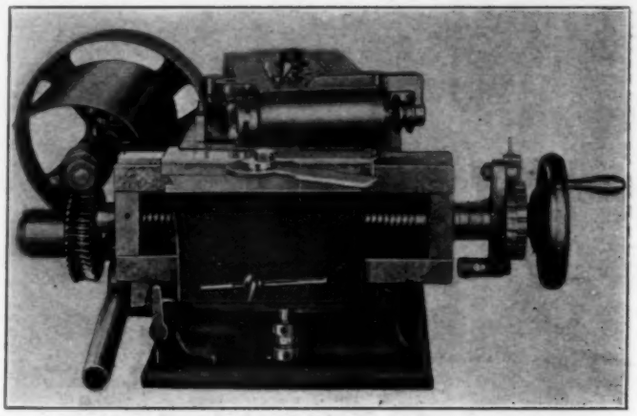


FIG. 15. RACK CUTTING MACHINE

of the microscope which is mounted on the center line of the workspindle. This insures the teeth being cut centrally. The microscope can be also used for inspecting and finishing product before it is taken from the machine. The crossline scale is etched with evenly-spaced radial lines representing the center lines of the teeth. When the finished job is observed it appears as in Fig. 12, which gives at a glance an indication of anything wrong with the set-up.

Roughing and Finishing the Pinion

In the machine shown in Fig. 13 the pinion is both roughed and finished. After the roughing operation the cutter head is moved to bring the finishing cutter into proper position for its work. Here in the same way as before, the microscope is set central with the pinion and the cutter stops adjusted to bring the cutters central. The index plates used on both types of machine were cut by using the dividing head shown in Fig. 14. The ordinary index plate on the head is replaced by a plate carrying index marks graduated on the dividing engine used for high-grade surveying and astronomical instruments. The microscope *A*, equipped with a prism tube to make more easy the observation by the operator, is used to set the lines on the graduated plate in position. This arrangement permits of extreme

accuracy. The gears used on the machine shown in Fig. 13 were also cut on this outfit to insure accuracy of the spiral to be generated.

The racks are cut on the machine shown in Fig. 15. The indexes of these machines are cut the same as those on the pinion cutting machines and the lead screws inspected for lead on the contour projector with the aid of a lead measuring attachment shown in detail in Fig. 16. This device consists of a micrometer head with a large graduated drum on the spindle and the spindle arranged to stop against a dial gage mounted in line with it. The micrometer is mounted on the movable slide which

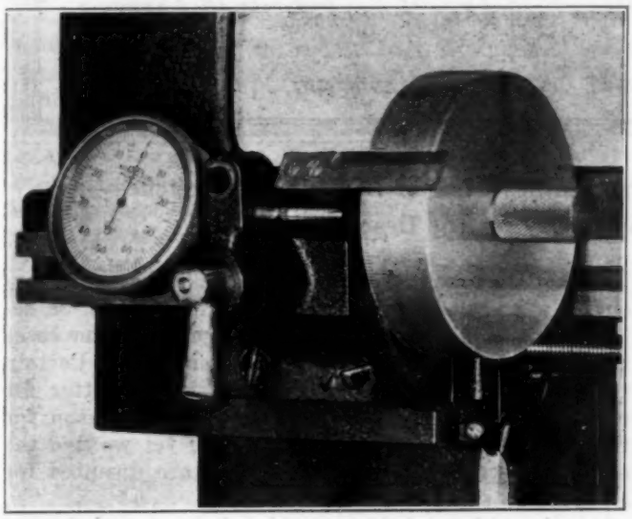


FIG. 16. LEAD MEASURING ATTACHMENT

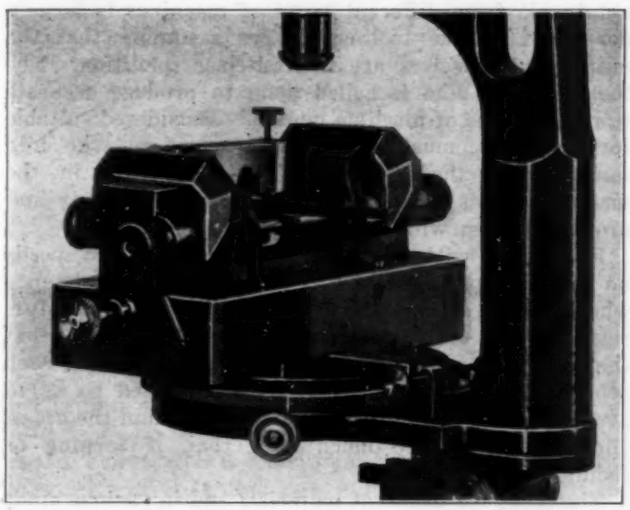


FIG. 17. CHECKING RACK AND PINION

carries the screw to be tested and the dial gage is mounted on the stationary base. The image of the projected thread is moved along so that one side of the V coincides with a master line on the chart and the amount of movement from thread to thread is measured by means of the micrometer, the dial gage simply acting as a zero point to avoid error due to sense of touch.

As a final check the indexing of the machine is inspected at intervals by fastening an accurately graduated bar on the bed of the machine and viewing it under the crosslines of a microscope mounted on the slide as the machine indexes along. The finished rack and pin-

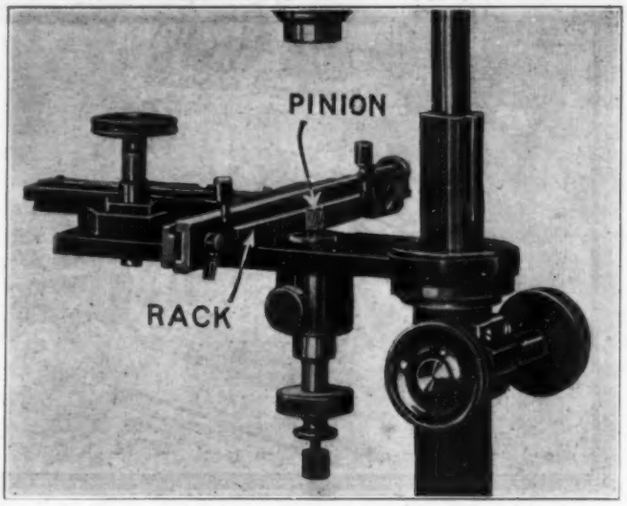


FIG. 18. OBSERVING ROLLING ACTION UNDER THE MICROSCOPE

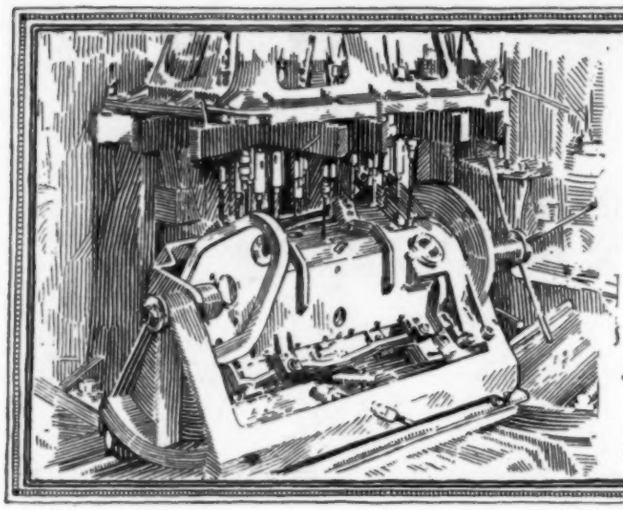
ion, before being used, are placed in mesh on gages shown in Figs. 17 and 18 and the angle of spiral and the rolling action observed. The gage, Fig. 17, for checking the angle of spiral is constructed to hold the pinion between centers with the rack in mesh and held down by a slight spring pressure. A microscope with a crossline is so located that if the angle is correct, the side of the rack will coincide with the line.

The gage shown in Fig. 18 consists of a fixture to hold the parts to be tested in position, the rack being mounted on a slide that can bring it up into mesh with the pinion. The pinion is mounted in a bearing so that it can be revolved by means of a button. A microscope is mounted above the point where the mesh occurs and the rolling action observed directly.

Periodically, a pair of members is projected and photographic records, Fig. 19, made and filed for future reference.

Only after years of patient work in the development of the methods described was it possible to produce work that could be assembled without fitting and lapping. Not only was the aid of optics necessary to produce the required accuracy, but it was also needed to bring about a speed of operation and inspection that was commercially imperative.

FIG. 19. PHOTOGRAPH PROJECTION OF RACK AND PINION



Tool Engineering

By
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Methods Employed in Designing Tools for Turret Lathes—Use of Layouts and Sketches—Familiarity with Machines Necessary for the Designer

THE methods of manufacture used on turret lathes should be determined by the tool department, and not by the department foreman. If the tool department has not sufficient knowledge to do this, a capable man familiar with this class of work should be obtained as soon as possible. Factory procedure varies in this matter; some believe the department foreman the best man to make "set-ups" for various jobs; others believe that the work can be done more profitably by the tool engineering department. We do not wish to argue the points, but will content ourselves with the statement that turret lathe departments in which the work has been properly planned and tooled by a capable tool engineer familiar with this kind of work, show a production far in excess of that obtained when the department foreman is responsible for the methods of tooling.

This statement is not intended to reflect on the department foreman in any way, as his province is not to provide tools and study methods of handling, but rather to produce the work with tools which are furnished to him. Jigs and fixtures are designed by the tool engineer, and there is no valid reason why turret tooling should not be handled in the same manner. As a matter of fact, the principal reason why a turret lathe department foreman is often called upon to make turret lathe set-ups is because the tool engineer has neglected this important phase of his business, and is therefore not capable of doing the work properly.

Lack of specific knowledge regarding the operation of turret lathes is one of the principal reasons why tool engineers often feel "out of their depth" when methods of handling work on turret lathes are to be considered. By consistent study of various turret lathes and by getting into the shop and operating the machines, a tool designer can soon obtain sufficient knowledge to enable him to grasp the important points connected with the arrangement and use of turret tools. No branch of tool engineering is more interesting and instructive than turret lathe work, and the field is wide enough to allow a capable man to rise rapidly if he specializes along this line.

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One of the first considerations in making a turret layout is a knowledge of the machine which may be selected or specified on the operation sheet. In some cases the selection may be left to the tool engineer. Certain types of machines are generally considered better for roughing operations, but there is no good reason for this except the power of the machine; yet we find the opinion prevailing that certain types are unsuited for accurate finishing.

At the risk of being considered too broad in our statements, we say that in our opinion the accuracy obtainable from different types of machines is largely dependent on the tooling, always assuming that the machines themselves are in first-class condition. The tool engineer who is called upon to produce accurate work on a type of machine generally considered suitable for roughing, must design tools so as to take into consideration the possibility of inaccuracies in the machine. This can be done by piloting all tools and providing them with accurate adjustments.

Familiarity with the ratio of cutting feeds and speeds on a given type of machine is of considerable assistance when making a turret layout. The cross-slide and turret feeds are often working at the same time, so that the tools on turret and cross-slide are approaching each other. The feeds used can be proportioned so as to avoid interferences. In a grooving operation the cross-slide feed would be much finer than if turning or facing.

The feeds for different materials and in various kinds of cutting operations will be treated separately, but the tool engineer should familiarize himself with the subject in order that his designs may be consistent. Actual shop practice is of great assistance in this regard, and the man with first-hand information, gained by actual work in the shop, has a decided advantage over another not so well posted.

Turning, boring, facing and grooving operations are often done simultaneously in order to obtain maximum efficiency. The highest production is obtained by continuous cutting, thus doing away with idle time of the machine. In making the tool layout the expert engineer takes special pains to design tools that take advantage of multiple cutting, thus removing the stock as rapidly

as possible. On thin work, which is likely to be distorted, it is a good idea to take all roughing cuts before any finishing is done. After the "skin" on the casting has been removed, the internal stresses are relieved and there is less likelihood of distortion in the finishing cuts. If, however, only a part of the work is roughed off when finish cuts are taken, the work may change slightly after the final roughing cuts are made, thus causing inaccurate work.

The matter of interferences of tools with each other or with portions of the machine while indexing has been mentioned in a previous article. The tool layout should be so made that any interferences will be clearly apparent, and suitable remedies can be applied. Care should be taken to show all tools in their actual positions with relation to each other, usually at the completion of a cut.

If turret tools are turning and boring while cross-slide tools are facing, it is advisable to show the turret tools in the position that they would be in at this stage tools in the position that they would be in at this stage of the operation. In other words, if the turret feed is 0.040 in. per revolution while the cross-slide is grooving at 0.007 in. feed, the turret may complete its work before the cross-slide tools have finished. In this case it may be possible to bring up the tools on the next turret face and put them into operation before the grooving has been finished. These points should all be considered in making a turret layout.

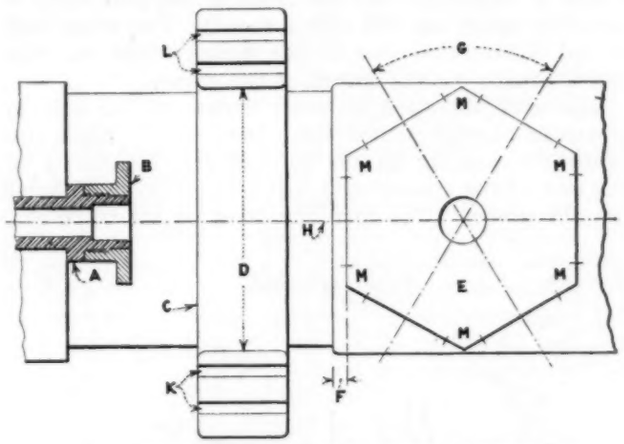


FIG. 373. TOOL ENGINEER'S MASTER LAYOUT FOR TURRET LATHE

The first step in tooling a piece of work on a turret lathe is to make a sketch to show the general method used. This sketch is usually made freehand by the tool engineer, and it is used as a guide in the design of the necessary tools. The procedure varies; some men favor the design of tools first and after this make a layout to scale, while others first make the layout and design the tools from it. The latter method is much to be preferred, but it requires a capable man to make the layout, one who really designs the tools roughly while making the drawing. Such a man, who is thoroughly familiar with the machines on which he is working, can rough out several complete layouts in a day to approximate scale.

In order to carry out this layout work to advantage and obtain the best results, layouts are most commonly made on tracing paper under which has been placed a scale drawing of the turret, spindle and cross-slide in their respective positions. The master drawing may be made to $\frac{1}{8}$, $\frac{1}{4}$ or $\frac{1}{2}$ size, according to preference. The $\frac{1}{4}$-size layout is often used and will be found all right for a large proportion of the work. Fig. 373 shows a master sheet used for this purpose. If a number of types of machines are in general use, it would be necessary to have a master sheet for each machine. As this sheet is used frequently, it is advisable to make it in ink on tracing cloth. The center lines should be well defined, so that they can be clearly seen when tracing.

In the example, the spindle *A* is shown in section and an adapter *B* of standard form is mounted upon it. It is only necessary then for the tool engineer to place his chuck or fixture in the correct position on the spindle, either screwing it in place or mounting it on the adapter. The cross-slide *C* is shown full length, and the distance *D* is laid out according to the dimensions on the machine. T-slots are shown at *K* and *L*, so that when tools are applied to the front and rear of the cross-slide they will be in their exact relation to each other.

The turret shown at *E* has all the center lines shown at *G*, in order that tools may be placed in their proper positions. Center lines at *M* on each turret face indicate the position of bolts used to fasten the tools to the faces of the turret. The line *H* is very important, as it represents the center line of both spindle and turret. On certain types of machines the base of the turret slide extends a short distance ahead of the face of the turret, as shown at *F*. As this projection would strike the cross-slide, it should be clearly indicated as at *F* in order to prevent interferences.

A master sheet of this sort is of great help when making turret layouts, and it can be made in a size suitable for the finished layout or for the freehand sketch. There is much less likelihood of errors in proportioning tools when the tool engineer who plans the work has a sheet of this sort to use as a guide. Freehand sketches are often more or less out of proportion, and this fact sometimes causes trouble when making the final layout.

In Fig. 374 is illustrated a freehand sketch with notes, as often made by the tool engineer. The work shown at *A* is a flange which is to be turned, bored,

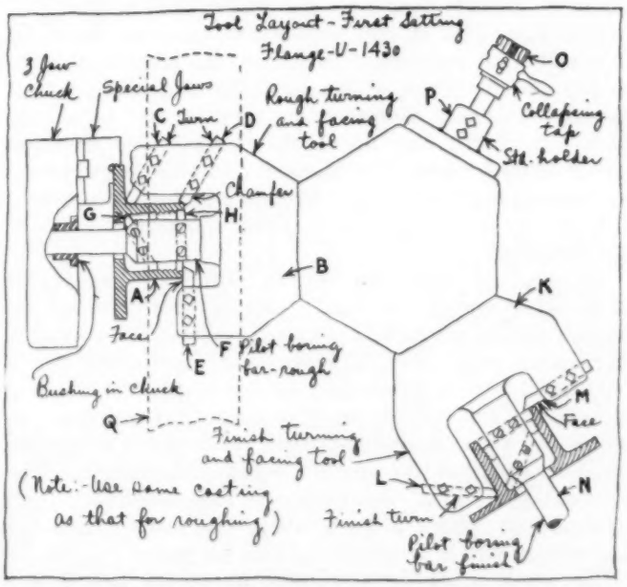


FIG. 374. TOOL ENGINEER'S FREEHAND SKETCH OF TOOL EQUIPMENT FOR TURRET LATHE

chamfered, faced and threaded. The turning, chamfering and facing operations are accomplished by using a special turning and facing tool *B*. The tool *C* does the turning, *D* cuts the chamfer on the end of the work and *E* faces the end. A boring bar *F* is piloted in a

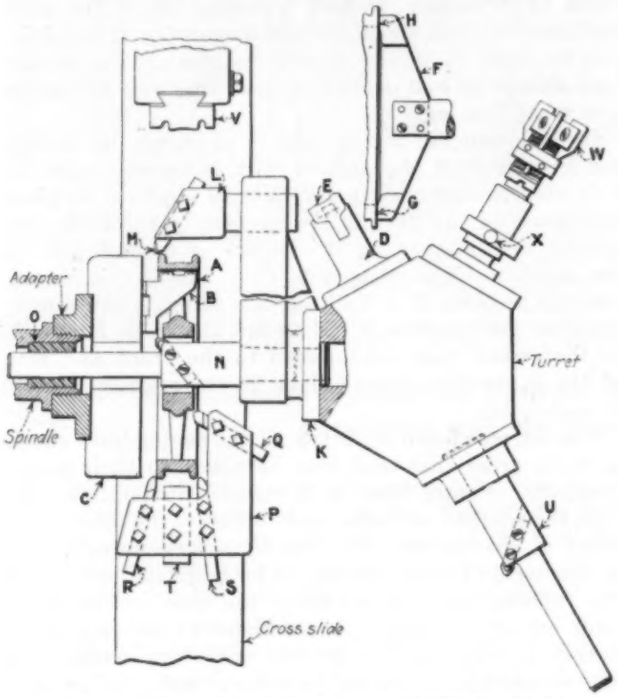


FIG. 375. TOOL LAYOUT FOR GROOVED PULLEY

bushing in the chuck. This boring bar has two tools *G* and *H*, the former doing the boring while the latter cuts a slight recess at the end of the work.

The finishing tool *K* is provided with turning and facing tools at *L* and *M*, respectively, and a finish-boring bar *N* is used in connection with these tools. The thread is cut by means of a collapsing tap *O* mounted in a standard holder *P*. The cross-slide of the turret lathe is not used in this setting, but it is necessary to build the various tools with sufficient overhang so that there will be no interferences. The position of the cross-slide is shown by the dotted lines at *Q*.

This last point is very well worth thinking about, as it is not at all convenient to remove the cross-slide completely on any type of turret lathe and there is not usually sufficient clearance so that it can be moved back out of the way under the chuck. The freehand layout shown contains a number of notes to guide the tool designer in his work. The various tools are briefly specified in writing, so as to make the matter clear to the designer.

In order to make the various points of importance clear with respect to turret tool layouts, several examples will be given here with explanation to cover each particular case. Fig. 375 shows a tool layout for a horizontal turret lathe used in machining the grooved pulley *A*. In considering this layout let us first examine the work, noting that both sides of the flange are finished and that the hub is bored and reamed. The grooved portion of the pulley is also finished. It is desirable to complete the work in one setting, and the tool equipment is designed for this purpose.

The work is held by the inside in special jaws *B* in a three-jaw universal chuck *C*. These chuck jaws are cut away so that the facing tools can pass by and finish the edge of the flange without interference. The method of setting up this work is by means of a chucking spider shown at *D*. This spider is so arranged that the portion *E* stands vertically, as shown in the side view at *F*. It bears against the edge of the casting at *G* and *H* and assists greatly in straightening it up while the chuck jaws are being tightened. The work is placed on the jaws slightly in advance of the position which it will take when machining. The jaws are then brought up lightly on the inside of the work, and the turret is moved forward by hand so that the chucking spider comes against the face of the flange and pushes it on the jaws to a distance predetermined by setting a stop on the turret slide. After this the jaws are tightened sufficiently to hold the work.

The holder *K* is fastened to the first turret face and contains a toolholder *L*, in which the tool *M* is used for turning the outside diameter. A boring bar *N* is used at the same time, and the end of this bar is piloted in a bushing *O* in the spindle. The turning tool is really in a vertical position, but is shown horizontally in order to illustrate the action clearly in one view. While the boring and turning operations are going on, a special toolblock *P* on the front of the cross-slide is used for facing the hub with a tool *Q*. Two other tools *R* and *S* face the sides of the flange, while the wide tool *T* roughs out the bottom of the groove.

The next operation is finish boring of the hole by means of another piloted bar, shown at *U*. While this operation is going on the dovetail forming tool *V* at the rear of the cross-slide is put into operation to finish out the groove. The final operation on the work con-

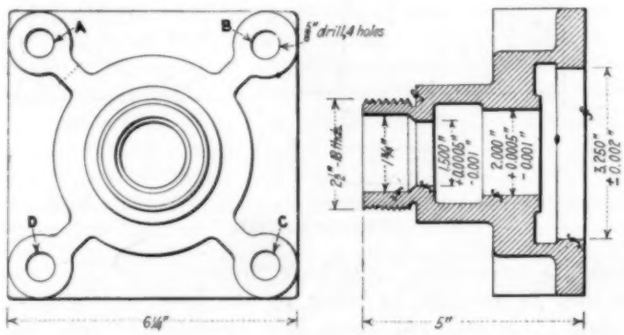


FIG. 376. WORK REQUIRING TWO TURRET LATHE OPERATIONS

sists of reaming the hole with an adjustable reamer *W* in the floating holder *X*.

The toolholder *K* is a standard type and can be purchased in considerable variety in the open market. The adjustable reamer is also a standard make, but the other tools shown must be built specially to suit this particular piece of work. It is advisable to use standard tool equipment for turret lathe work when possible, providing the production can be kept up to the maximum. When work is out of the ordinary and heavy cutting is necessary, special toolholders are often required.

The work shown in Fig. 376 requires two turret lathe operations, and both layouts are shown in order to illustrate the method of handling. The base of this casting is square and there are four holes *A*, *B*, *C* and *D* as shown. In deciding upon a method of handling, it seems advisable to use a chuck for the first operation

if possible, as it makes the setting up so much easier. The holes through the center of the piece must be concentric, yet they cannot all be machined in the same setting. The method of handling, therefore, must consider two settings and the location for the second operation must be such that concentricity in the holes can be obtained.

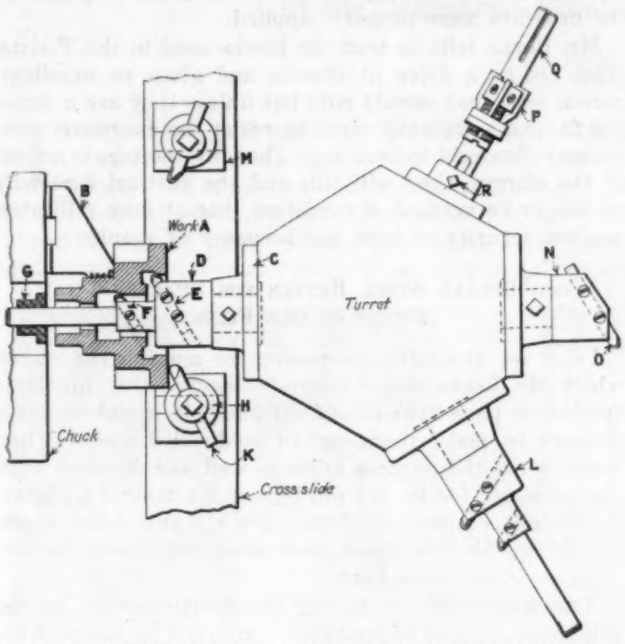


FIG. 377. FIRST LAYOUT FOR PART SHOWN IN FIG. 376

In Fig. 377 is illustrated the method used for the first setting. The work *A* is held by the outside of the hub in special jaws *B* in a three-jaw chuck. End location is obtained by the position of the work against the end of the chuck jaw. The toolholder *C* is used on the first turret face to hold a double boring bar *D*, in which are two tools *E* and *F*. The bar is piloted in a bushing *G* in the chuck. While this boring operation is going on, a standard toolholder *H* on the front of the cross-slide is used with a tool *K* for rough-facing the flange.

The second operation is identically the same as the first, except that the boring bar *L* is used for finishing two diameters in the hole while the facing tool *M* finish-faces the flange from the rear of the cross-slide. A reference to the work will show the dimension 3.250 ± 0.002 in. This is not a very accurate dimension, but the 2-in. hole is held close to size. In order to avoid the expense of a reamer for the large hole, a special boring bar *N* with a single-point tool *O* is used for sizing this hole. The final operation on the work in this setting consists of reaming the 2-in. hole with an adjustable reamer *P* having a pilot *Q* and being held in a floating holder *R*.

After the first turret lathe operation, the work is placed in a drill jig and the flange holes *A*, *B*, *C* and *D* are drilled. This operation is done between the two turret lathe settings in order to provide an effective method of driving for the second operation. It would be possible to do the drilling at another time and use a pin against the side of the casting to assist in driving, if for any reason the drilling operation would be inconvenient and require a great deal of extra handling.

In setting up for the second operation, the work is located by the plug *A* in the 2-in. hole, Fig. 378. A special faceplace fixture *B* has four hardened studs in it at *C*, and the face of the flange rests on these studs. The work is clamped in place by four straps *D*, and there are two pins (not shown) which enter the holes drilled in the flange and act as drivers. The holder *E* contains a bar *F* in which are two tools for boring the 1.500 and 1¾-in. diameters. This bar is piloted in a hole in the end of the locating plug, in order to preserve the alignment between the various holes.

The toolholder *E* has a vertical extension *G*, in which are two turning tools *H* and *K* for turning the outside diameters. This turning toolholder is shown in a horizontal position because it is more convenient to represent it in this way. The front of the cross-slide carries a toolblock *L*, in which the two tools *M* and *N* are set in such a position that they will face the shoulder and the end of the hub, respectively.

The second operation on the work is done by a holder *O* of similar form to that just mentioned. The tools carried in it are finishing tools for the same surfaces as those previously machined. The rear of the cross-slide is equipped with a block *P* carrying a tool *Q*, which finish-faces the shoulder and cuts a recess for the thread. The tool *R* finish-faces the end of the hub.

The next tool used is a reamer *S* carried in a floating holder *T*. This reamer sizes the 1.500-in. hole and is piloted in order to preserve the alignment. The final operation on the work is done by means of a diehead of the opening type, shown at *U*. Care must be taken in using large dieheads for cutting threads to make sure that the capacity of the machine is sufficient to permit the diehead *to swing over the back of the turret slide* when indexing.

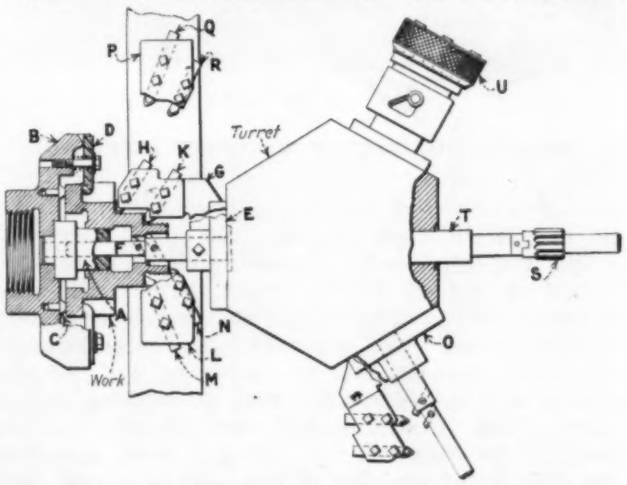
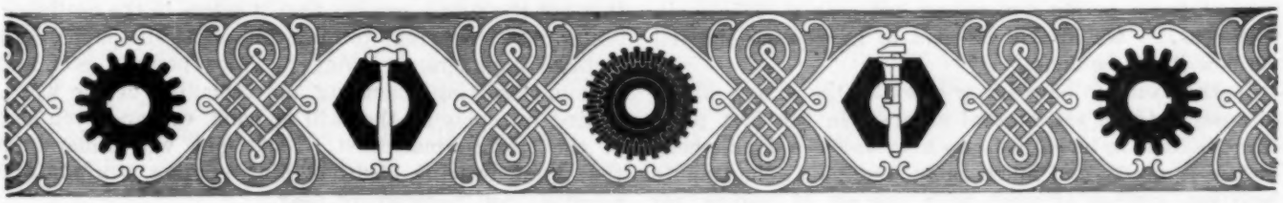


FIG. 378. SECOND LAYOUT FOR PART IN FIG. 376



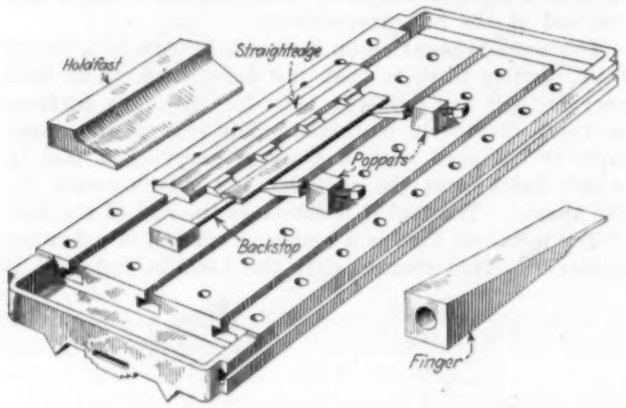
Planing Flat Gibs

By Harry Senior

The article appearing on page 219 of American Machinist under the title "Planing Flat Gibs," is of interest to the mechanic for several reasons. The introductory sentence in reference to the importance of devoting proper attention to clamping methods, is indubitably correct. The statement that there are many planer hands that have not grasped this fact, is open to question.

It would seem to me that any man who had worked long enough on a planer to be entitled to the designation of planer hand would have demonstrated to himself the importance of clamping methods, for the reason that unless his work was of a very rudimentary nature it would otherwise be impossible for him to obtain results that could be assembled.

Though I have seen many planer hands that did not know *how* to clamp an unfamiliar piece without springing it, I have yet to see a man who has worked more than a week upon a planer who did not thoroughly understand that if a piece was sprung in clamping, it would not be straight when released.



HOLDING THIN NARROW PIECES FOR ACCURATE PLANING

That the object to be attained in clamping work is to prevent it from shifting under the cut cannot be gainsaid. This tendency to shift must be guarded against in all directions. Not only must a sturdy backstop be interposed against endwise movement and suitable clamps used to prevent the work from being shifted sidewise, but it must be held *down* as well; and the necessity for resistance to a lifting moment, as well as the difficulty of applying it, increases in inverse ratio to the thickness of the piece.

Cost of Experiments in Trying to Plane Thin Work on a Production Basis

Anybody can, without difficulty, plane parallel a piece of iron 14 x 18 in. in size and 6 in. thick, but I once spent a good many hundreds of dollars of my own and other people's money in trying to find a way to machine, on a production basis and to 0.0005 in. limit, pieces of iron of those major dimensions but only 0.0625 in. in thickness. I would still be glad to have some one tell me how it can be done.

In the example of planing cited by the article under discussion there are several errors. In the first place there is little to be gained (nothing unless a double-head planer is used) and much to be lost by attempting to hold two strings of work with one set of clamps, for trouble in one string invariably involves trouble in the other and half the work of setting up has gone for nought. Again, there is no resistance to a lifting moment except the vise-like grip of the shoes, and this must be several times greater than would be required if the pressure were properly applied.

Mr. Berna tells us that the blocks used in the T-slots must not be a drive fit therein and gives an excellent reason *why* they should not; but unless they *are* a driving fit, and sufficiently tight to resist the enormous side pressure brought to bear upon them by the toggle action of the clamps, they will tilt, and the vertical face will no longer be vertical, a condition that at once militates against security of hold and accuracy of results.

Cold Rolled Steel Better for Spacers Than Pieces of Old Files

I can see absolutely no reason for making the pieces which Mr. Berna calls "spacers" (marked *C* in his illustration on page 219) out of old files. It would be much cheaper to make them out of cold-rolled steel. They would serve the purpose quite as well and do away with the necessity for having old bits of file around a planer, a pernicious practice. There are circumstances under which the file bits have their uses, but these circumstances do not exist here.

The desirability of having the under surface of the gib bowed instead of concaved is entailed by the position of the clamps. If there were three clamps to each piece, or if two clamps only were so spaced as to divide the length into thirds (one-third being the combined lengths outside of each clamp) the necessity would not exist. As for bending a cast-iron gib to make it conform to the requirements, how many machinists that have tried to bend a piece of cast iron of this section will agree with Mr. Berna that it is "easy"? It is no simple matter to bend even a *steel* gib, unless you are disposed to consider a "kink" a bend.

In my opinion the proper way to hold these gibs for planing would be to put a "straightedge" on the planer (using a double-faced straightedge in the central slot if thought advisable to plane two strings at one setting) and interpose between it and the work a suitable number of those peculiarly shaped pieces called "holdfasts" in machinists' parlance. The clamping pressure may be applied by toggles as shown by Mr. Berna, but the pieces he calls spacers *should bear directly upon the work* and not upon a separate shoe. Here, and here only, is the use of the file bits justified, and for an entirely different purpose than when used with a separate shoe. Suitably shaped fingers of hardened steel, used in connection with poppets, would be much better.

I have endeavored to show in my illustration my idea of the way to hold a thin narrow casting, such as Mr. Berna has cited, for accurate planing; and this method applies just as forcibly when thousands of pieces are to be produced as when but a single casting is desired, provided real accuracy is essential. It is, however, beyond the scope of a magazine article to teach the art. It is not the simple process that it seems in the outlining but is one that brings to mind bits of tissue paper, lead or brass hammers, steel fingers, stops, poppets, etc., and constant shifting, clamping and replaning of the work, calling into play all the skill of hand, eye and even ear, of the trained machinist. Such men will understand that I am writing about planing a piece *straight* and *parallel*; not "somewhere near."

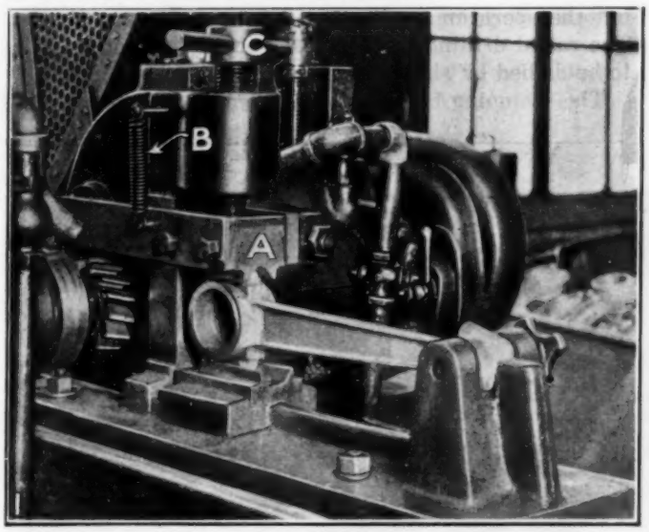
Mack Connecting Rod Methods

Some Unusual Fixtures for Milling and Slitting—A Sequence of Operations that Is Out of the Ordinary—Final Straightening and Inspection

BY FRED H. COLVIN
Editor, AMERICAN MACHINIST

THERE are two sizes of motors used in Mack trucks, the smaller having the two-bolt and the larger the four-bolt method of fastening the connecting-rod caps in place. The connecting rod is of sturdy design as befits a heavy-duty motor, and yet is not clumsy in any way. Both types of rod are shown in connection with the machining operations. While utilizing the four-bolt bearing-fastening on the rod for the large motor, the rod is made as light as possible, particularly on the small end where it is desirable to reduce the weight of reciprocating parts to the minimum. The large end, of course, is a rotating member and can be easily balanced.

After annealing and heat-treating, the forgings are given a preliminary straightening, are inspected and sandblasted after which they are snagged to remove the flash left by the forging dies. The machining operations begin with the milling of the crankpin end in the double-spindle Cincinnati machine, shown in Fig. 1. The large end of the rod is held by the bolt bosses by means of the V-blocks shown, the upper block *A* being lifted out of the way by the spring *B* as soon as the clamping screw *C* is released. The small end is clamped between centers which fit into depressions left by the forging dies.



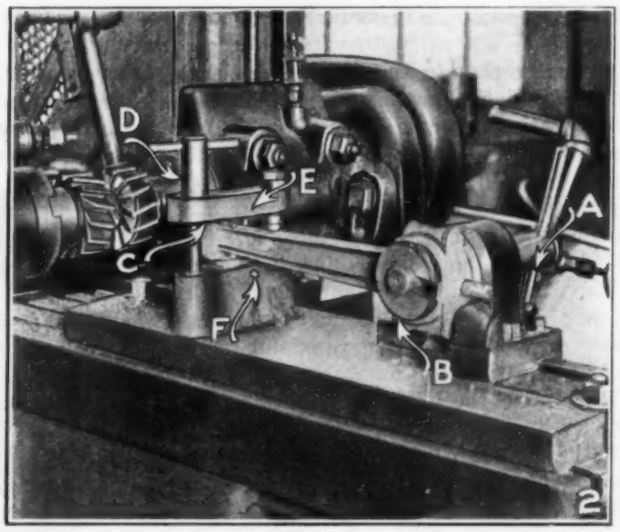
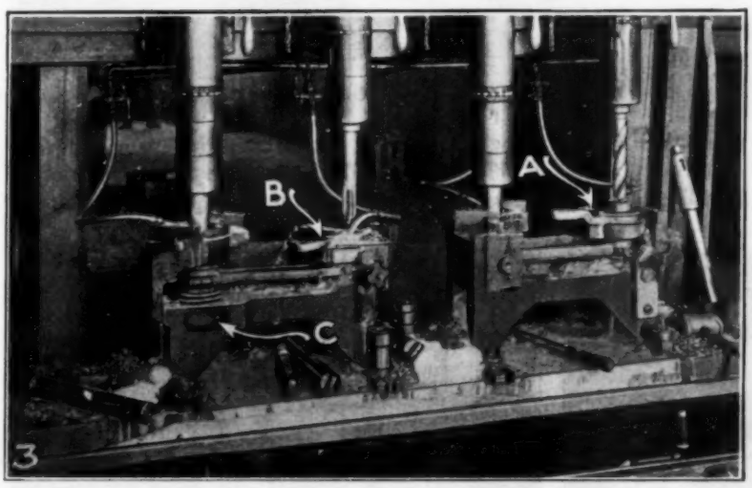


FIG. 1. MILLING SIDES OF LARGE END. FIG. 2. MILLING THE SMALL END



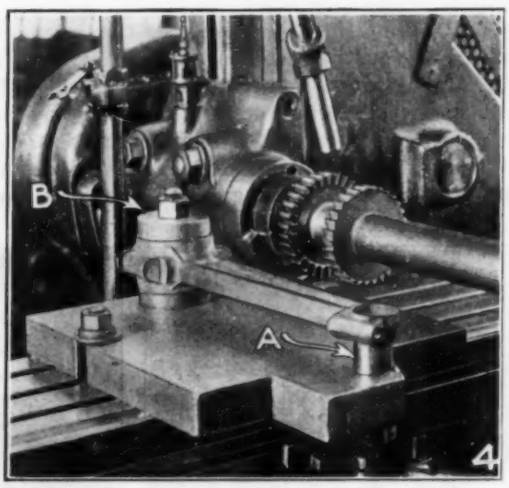


FIG. 3. DRILLING AND REAMING BOLT HOLES. FIG. 4. FACING THE BOLT SEATS

The small end is then milled on a similar machine, as in Fig. 2. The rod is clamped against the milled faces by means of the screw *A* and the open washer *B*. The small end is held by the clamps shown which consist of hardened round-ended pins. These pins are held in place in the upper and lower clamps, the upper clamp *C* being readily swung out of the way for remov-

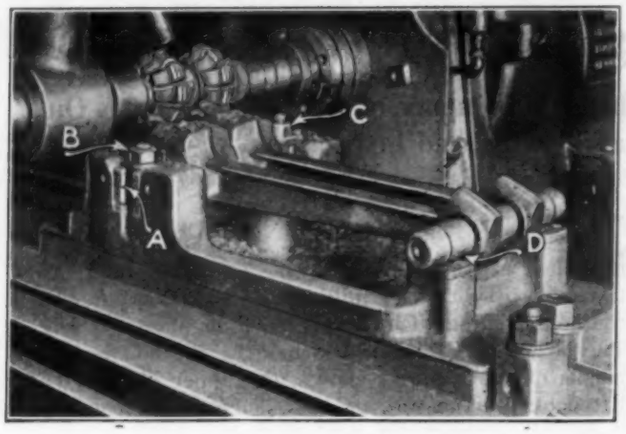


FIG. 5. MILLING BETWEEN BOLT BOSSES

ing and replacing the rod. The clamp screw is at *D*, and *E* and *F* show the pins which act as fulcrums for the floating clamps. The clamps allow the rod to be self-centered without distortion, so that the faces on each end will be milled parallel.

Next comes the drilling and reaming, both operations being shown in Fig. 3. The fixtures are not unusual in design, although the quick-acting bushings shown at *A* and *B* have much to commend them. This illustration shows the way in which the rods are held and also shows very clearly the provision made for the escape of the cutting lubricant by coring a passage as at *C*. This allows the lubricant to flow through the hole being bored and to wash the chips completely out of the way. Both holes are then broached, after which the bolt seats are milled, as shown in Fig. 4. The rod is positioned by the pin *A* which fits the small end, while the clamp *B* holds the large end firmly during the milling cut. The rod is then reversed and the opposite side milled.

In forging the four-bolt rod, the large end is left solid between the bolt bosses, as shown in Figs. 5 and 6. Fig. 5 shows how the rod is lightened by milling the space between bosses and also the way in which it is supported. The rods are milled in pairs, the mandrel *A* fitting both rods and having ends which are squared and slotted for clamping by the bolts *B* and *C*. The mandrel *D*, supports the small ends and holds both rods in line. Fig. 6 shows a rod both before and after milling and also gives a clear idea of the construction of the mandrel *A* by which the large ends are centered and clamped.

The projection on the lower end of the rod, known as the oil scoop, is next drilled, as shown in Fig. 7. The large end of the rod is placed over the stud *A*, while the projecting scoop is centered by jaws *B* and *C*, which are moved by the handle *D*. The drill is guided by the bushing in the plate above. This fixture enables the work to be handled very rapidly.

The bolt holes are next drilled in the fixture shown in Fig. 8, the rod being located on the studs *A* and *B* and held in position by the swinging clamp *C*. This view shows the drilling of one of the two-bolt rods, but the operation on the four-bolt rods is very similar. The radial drilling machine used enables the other holes to be drilled by simply swinging the arm.

The clamping-bolt hole is drilled and tapped in the fixture shown in Fig. 9, which requires very little explanation. The large end of the rod is over the piece *A* and the small end over the supporting mandrel *B*. The

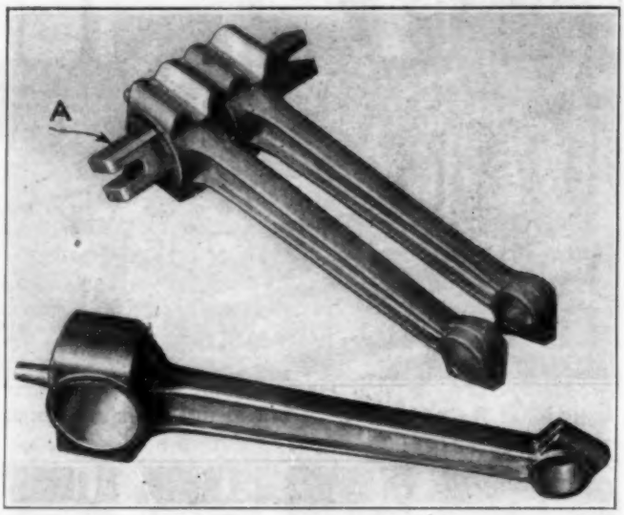
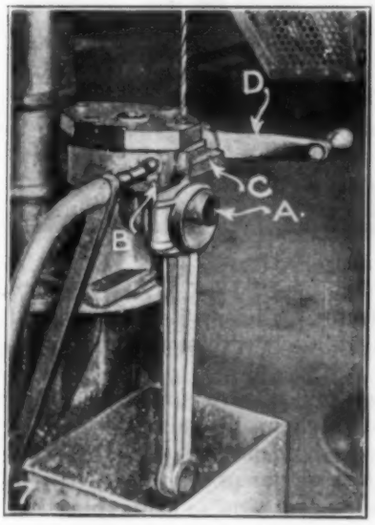
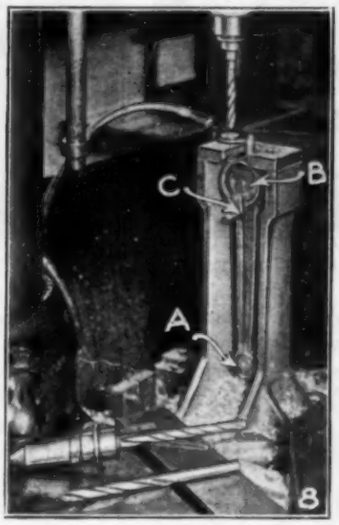


FIG. 6. ROD BEFORE AND AFTER MILLING





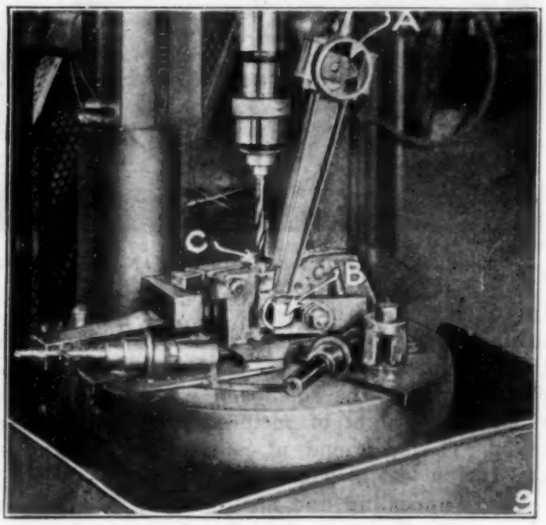
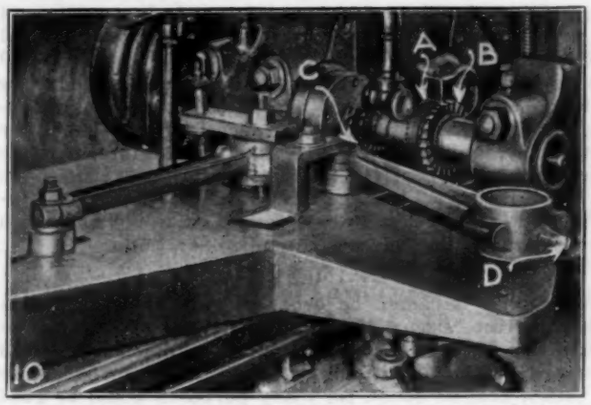


FIG. 7. DRILLING HOLE IN OIL SCOOP. FIG. 8. DRILLING BOLT HOLES. FIG. 9. SLITTING ROD AND MILLING OIL SCOOP



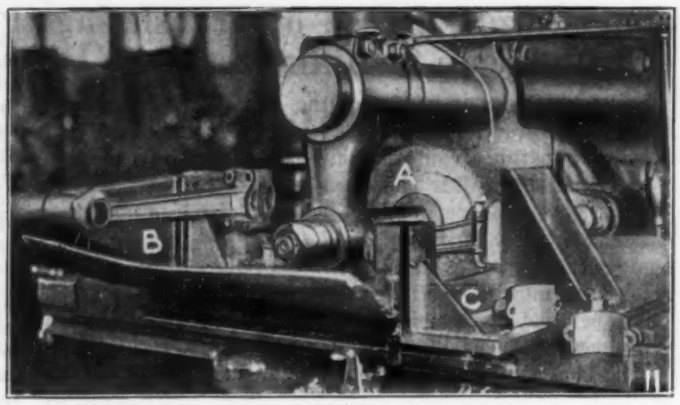


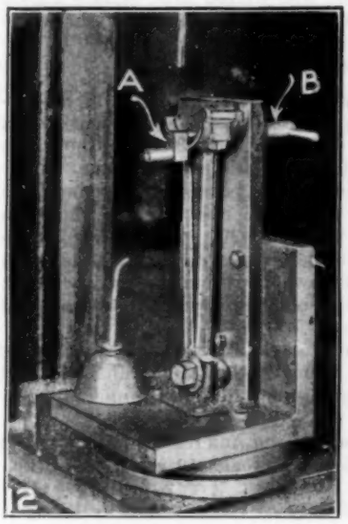
FIG. 10. DRILLING AND TAPPING PINCH HOLE. FIG. 11. MILLING CAPS FROM THE ROD

drill bushing *C* swings out of the way for the tapping operation.

The piston-pin end is slit and the oil scoop milled in a double operation shown in Fig. 10. The slitting saw for the piston-pin end is shown at *A*, while the cutter *B* faces the boss for the clamping bolt. The oil scoop

back against the rod by the screw *B*. The clamp *A*, when released, can be easily swung up out of the way so as to make removal and replacement of the rods an easy matter. The fixture revolves on its round base to bring the other hole under the cutting tool.

The pinch-bolt hole is then retapped and burred,



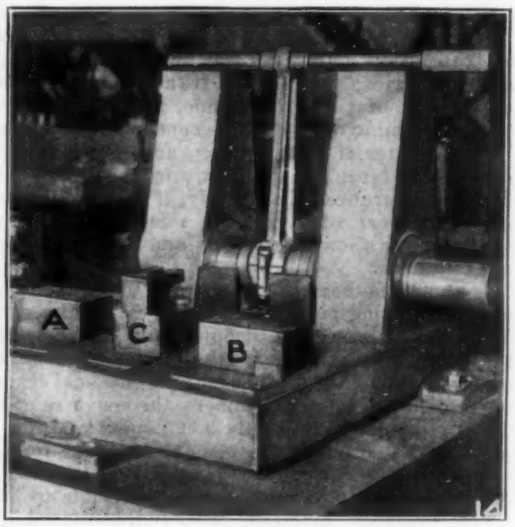


FIG. 12. COUNTERBORING AND REAMING BOLT HOLES. FIG. 13. INSPECTING AND STRAIGHTENING. FIG. 14. THE FINAL INSPECTION

is being milled at *C*, this operation cutting away half of the projection, as can be seen at *D*.

The sawing of the cap from the rod is shown in Fig. 11, a knee type milling machine with a double fixture being used for this purpose. The slitting saw is shown at *A* and the two holding fixtures at *B* and *C*. One rod can be changed while the other rod is being sawed, so as to make nearly a continuous operation.

The bolt holes are then reamed and countersunk in the fixture shown in Fig. 12. Here the small end of the rod fits over the lower stud while the upper end is held in position around the upper stud and against the shoulder by the swinging clamp *A*, which is drawn

after which inspection and any necessary straightening takes place, as shown in Figs. 13 and 14. It will be noted that these fixtures are very substantial so as not to be sprung by any straightening which may be necessary. The type of wrench used is shown at *A*.

Fig. 14 shows the testing fixture in more detail, from which it will be noted that the usual steel surfaces test the squareness of the rod in both directions. The test bar in the small end swings down onto the blocks *A* and *B*, and the movable block *C* then locates the small end with relation to its parallelism with the large end. It also shows whether or not the faces of the small end are in correct alignment with the large end.

Standardized Method of Translating Inches to Millimeters

The Sectional Committee of the A. S. M. E. on Plain Limit Gages for General Engineering Work has received a communication from the standardizing body of the Netherlands regarding the translation of inches to millimeters. After careful consideration the commmittee has through its chairman, E. C. Peck, general superintendent, Cleveland Twist Drill Co., prepared the following statement:

It is believed that the necessity for a standardized method of translating inches to millimeters has been brought about by the lack of interchangeability found in many articles of manufacture and commerce. A mere agreed upon method or standard method of translation will be of little value unless it admits of interchangeability in all manufactured product in which the inch dimensions have been translated to millimeters. Interchangeability demands as a fundamental principle that there can under no circumstance be an unintentional interference of metal between mating parts. This means that strict interchangeability does not exist if through any cause (viz: the wear of gages, the inaccuracy of gages, or the translation of inches to millimeters) there is permitted an interference of metal that is not intended.

It seems equally important that the standardized method of translation must meet the requirements of all the arts and industries; that is, the translation must meet the requirements of those doing fine, accurate work as well as those making articles of more common commercial accuracy.

As a matter of fact, the accuracy of this translation is of more importance to the fine work because of its smaller working tolerance. Conversely, it is less vital to those engaged on work of a common commercial kind on account of the larger allowance for fits and the greater manufacturing tolerance.

It should be borne in mind that to avoid interference of metal in mating parts for the purpose of interchangeability, decimal places may be dropped for the dimensions of internal members; but, if the decimal figure dropped is greater than five, the remaining decimal cannot be increased. For external members, the converse of this is true. To illustrate: ⅜ in. equals 9.525 mm., and for some purposes 9.53 mm. might be satisfactory; but for the internal members of a pair of mating parts in which a good fit is demanded, this 9.53 mm. makes it possible to have this internal member nineteen one-hundred-thousandths of an inch too large to be received by a correct gage. Hence, there is an interference of practically two ten-thousandths of an inch.

Must Suit Present and Future Generations

Any standard method of translation proposed must not only suit the needs of the present generation but those of future generations. Methods of manufacture are being refined each year, and the requirements of machinery as regards accuracy of product are becoming more exacting. Methods of measuring are being improved so rapidly that in gage-making the gage tolerance is spoken of in terms of millionths of an inch, and several manufacturers of gages guarantee their product to be within a tolerance of ten millionths of an inch, or roughly, about one-fourth of a micron.

It must, therefore, be evident that the only method of translation which will suit all cases and work a hardship on none is that which translates in the smallest measurable units that are at the same time workable. This, then carries the translation of inches into microns, and it will be shown that this is not too small for good work and at the same time will not penalize those industries using measurements which do not require great accuracy. When inches and decimals are used, the accuracy desired is obtained by dropping decimal places from the right-hand end; if a translation of inches into metric units and the fraction expressed in microns is used, then the desired accuracy is obtained in the same manner.

It is customary in many shops when a decimal place is dropped and the dimension remaining ends in zero, to call the work correct if it is ± .5 of the value of the decimal place dropped. To illustrate: 2¼ in. (2.250) equals 57.150 mm. and if the zero on the right is dropped, it indicates that no accuracy is required beyond 57.15 mm. A dimension stated this way without tolerance leaves a chance for controversy, as it will rarely be exact. Therefore, it is the practice in some shops to interpret this to mean that if the work is between 57.145 and 57.155 mm., it is correct, because if greater accuracy were desired, it would have been expressed with the tolerance in microns; thus:

$$57.150 \pm \frac{0.000}{0.002}$$

meaning that it cannot be over but may be two microns under correct size. If the translation of 2¼ in. to mm. is carried to tenths of a mm., the dimension would have to be 57.1 or 57.2, and by the usual rule, it would be the latter, and, no doubt, for many purposes would be good enough, but for others entirely unsuitable.

Suppose this 2¼ in. dimension was a crank bearing of an automobile engine, the grinding dimensions would probably be 2.2495 in. to 2.2499 in. (good American practice). Then, the use of 57.1 or 57.2 mm. would not be near enough for interchangeability, as 57.1 mm. equals 2.24802 in., and 57.2 mm. equals 2.25196 in. If we carry out the translation to the nearest 0.01 mm., the dimension becomes 57.15, and with no tolerance expressed, we would, as figured above, use 57.145 mm. equals 2.2498 in. and 57.155 mm. equals 2.2502 in.; and for this work a juggling of tolerances might make it acceptable.

Gage Work

For gage work, however, all translations ought to be carried out to microns, as this is not too fine for this work. A micron is 0.00003937 in. or practically 39-millionths of an inch and the choice of which micron a measurement is intended to be leaves the value of the possible discrepancy as about 20-millionths of an inch, which is greater than the tolerance some gages are made to. It must, therefore, be evident that the metric system does not contain a unit small enough for the finest work now being done in this country, and it is prophesied that for some purposes the micron will be sub-divided into tenths.

We propose this method of translating inches into the metric system. Adopt the value of the American inch, 25.4 mm. as the basis of all translations of length, and my reasons are as follows:

(1) The error cannot equal one micron until 10 in. is reached and is only one micron for each 10 in. of length.

(2) It is fine enough for any work.

(3) If 25.4 mm. (carried only to tenths mm.) is used, as it will be for many purposes, the error is only one-tenth of a micron or practically four-millionths of an inch, a quantity so small as to permit of interchangeability for all industrial and commercial purposes.

(4) It allows the translation to be made by the simple multiplication of 25.4 by the inches or decimal fractions thereof. (Many divide the inches and fractions by 0.03937 to get mm.).

(5) For precision work, the computation may be carried out to the extreme decimal part of a mm. and used without changing the value of the inch as used in America.

(6) If tables are compiled on this basis, the accuracy desired will be determined by the user who will drop as many decimal places as suits his particular purpose.

Exhibition at Gothenburg

The Aeronautical Chamber of Commerce of America has received the program for the international aero exhibition which is to be held at Gothenburg from May 15 to Sept 10, 1923. This exhibition will be held in conjunction with the 300th anniversary of the foundation of the city of Gothenburg. The aeronautical part of the program will take place from July 20 to Aug. 12. It will be under the direction of the Royal Swedish Aero Club.

Further information about this exhibition can be had from the Aeronautical Chamber of Commerce of America.

Machine Tool Shops According to the 1919 Census

Analysis of the Figures Published in the Last Census of Manufacturers Show Interesting Economic Facts—Larger Shops Much More Efficient

IT IS quite likely that few business men realize the fund of information contained in our national census compilations. The documentary mass is usually so imposing that only an ardent seeker after facts has the perseverance to dig into it and come out with something valuable.

From the accompanying table, however, some interesting deductions can be drawn. The shops of the country making machine tools have been classified in four groups according to the dollar value of their product. The number of shops in each class is listed in the second column and the total value of their product in the third. The cost of the materials used is placed in the fourth column and the fifth column is obtained by substracting 4 from 3.

It should be noted that Class 2, over $500,000, means over $500,000 and below $1,000,000. Summations are made below the first set of figures and show, among other things, that the total turnover of capital for the year is slightly less than one, $\frac{212,400,000}{231,000,000} = 0.917$, to be exact.

The fact that 80 per cent of the product, measured in dollars, is made by 93 of the 403 shops and that 95 per cent is made by 277 is also worth noting. Taking only the shops with an output of over $1,000,000 we find that 13 per cent of the shops turn out 69 per cent of the total output.

If we now take into consideration the number of wage earners employed in each class of shop, we discover that the bigger the shop the larger the value of the product per wage earner employer. The same applies to the added value per wage earner.

Reducing some of these figures to a percentage basis it becomes evident that 13 per cent of the shops, the big ones, produced 69 per cent of the value of product and employed 66 per cent of the wage earners. On the other end of the scale 44 per cent of the shops, the little ones, produced but 3 per cent of the value of product and employed but 5 per cent of the workers.

The struggle for existence which confronts the small shop is indicated by the fact that even in a good year like 1919, it produced 25 per cent less per wage earner employed than the average of all shops.

Machine Tools—1919 Census

INVESTED CAPITAL $231,000,000.00

Class by Value	Number of Shops	Value of Product	Material Cost	Value Added by Manufacturers	Number of Wage Earners	Product per Wage Earner
1—Over $1,000,000	52	$146,142,000	$38,636,000	$107,506,000	35,525	$4,100
2—Over 500,000	41	27,856,000	7,847,000	20,009,000	7,235	3,869
3—Over 100,000	134	31,760,000	10,271,000	21,849,000	8,162	3,873
4—Under 100,000	176	6,642,000	2,280,000	4,362,000	2,186	3,030
Total all classes	403	212,400,000	59,034,000	.....	53,111	4,000
80 per cent—Class 1 and 2	93	173,988,000	46,483,000	.....	42,763	4,050
95 per cent—Class 1, 2 and 3	227	205,758,000	56,754,000	.....	50,925	4,032

Class	Added Value per Wage Earner	Ratio Added Value to Product	Ratio Material to Product	Material per Wage Earner	Per Cent of Shops	Per Cent of Value	Per Cent of Wage Earners	Wage Earners per Shop	Product per per Shop
1—	$3,029	74	26	1,071	13	69	66	683	$2,810,000
2—	2,766	71	29	1,103	10	13	14	176	679,000
3—	2,634	66	34	1,239	33	15	15	62	238,000
4—	1,946	67	33	1,084	44	3	5	12	38,000
Total	2,887	72	28	1,113	100	100	100	132	531,000
80 per cent	2,979	73	27	1,071	23	82	80	461	1,870,000
95 per cent	2,927	72	28	1,105	56	97	95	224	906,000

To Examine Ordnance Designs

L. W. Wallace executive secretary of the Federated American Engineering Societies, is in receipt of the following letter from Brigadier General W. S. Peirce, Assistant Chief of Ordnance of the Army:

"In reply to your recent letter referring to the matter of examination by the engineering societies of ordnance designs and especially in regard to the economy and facility of production in quantity, I take pleasure in informing you that, pursuant to your reference of the matter to the American Society of Mechanical Engineers, that society submitted the question to letter ballot by its ordnance division, and that ballot being in favor of the resolution, the same was adopted by the council of the A. S. M. E.

"Pursuant to this action by the A. S. M. E., it has been decided that the best plan of procedure will be for the Ordnance Department to submit drawings showing proposed designs, which the executive committee of the ordnance division, A. S. M. E., will refer to certain specially qualified members for criticism. Undoubtedly there will be further details of procedure to be determined from time to time, but it has been thought best to leave the matter until several particular cases have been handled."

Unique Power Plant in a Small Shop

By Ellsworth Sheldon

While prospecting around in Northern New England the other day the writer chanced upon a small garage and machine repair shop in which there was a power

FIG. 1. THE COMPLETE POWER PLANT

plant that displayed some novel, not to say unique, features.

The main unit in its original form has no particular claim to distinction. It was manufactured by the Ford Motor Co., of Detroit, and until the present owner lifted its mangled remains from a local automobile wreck, was exactly like thousands of its contemporaries that are still doing business in the ubiquitous Fords. But I doubt if in its present shape any of Ford's engineers would recognize it.

The complete plant, shown in Fig. 1, comprises a Ford engine so changed as to adapt it to kerosene instead of gasolene fuel; a 110-v. direct-current Bullock generator; a 56-cell chloride accumulator, and a device for producing distilled water as a by-product.

The accumulator cells are located in a large, well ventilated closet behind the switchboard and are not, of course, evident to the casual observer. The jars are of glass, of ample proportions to hold the plates without the necessity for wooden separators, and are neatly

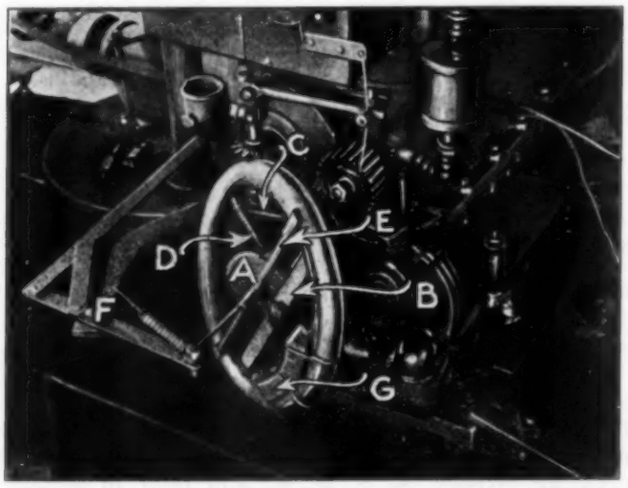


FIG. 2. THE GOVERNOR OF THE ENGINE

arranged in groups on several shelves so that any one cell may be removed for cleaning and another one substituted without disarranging the battery or interrupting the current except for the moment required to make the connections.

The plant is entirely self-contained. Despite the integrating wattmeter to be seen at the top of the switchboard, the proprietor neither buys nor sells current, all "juice" being made and consumed on the premises.

When I first saw the shop the power was not running but as I immediately evinced interest in it, the proprietor volunteered to "start 'er up." Casting an anxious look about the floor, he called to one of his men: "Frank, where is the crank we start this engine with?" "Dunno," responded Frank, "las' time I seen it it was down cellar behind the piano." As Frank spoke the engine started, and before I could turn to see how the thing was done, was in full operation.

The proprietor, hugely enjoying my puzzled discomfiture, allowed me to hunt for several moments to find the starter before he opened the closet door and showed me the storage battery. Not until then did I realize that it was the generator, running as a motor upon the accumulator current, that was doing the work. Opening the throttle and turning down a two-throw switch on

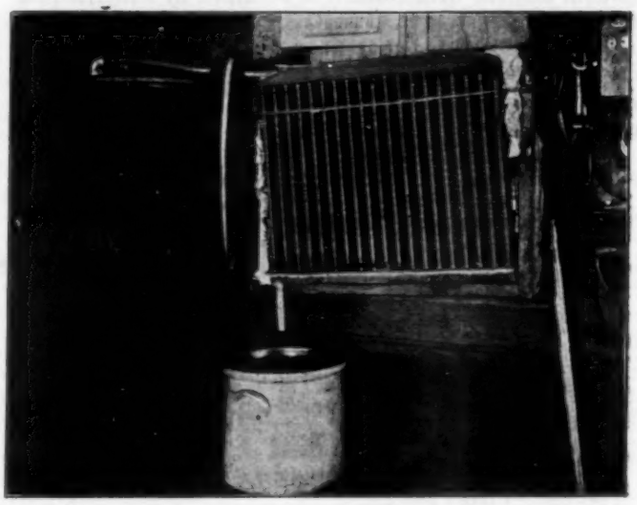


FIG. 3. THE "DISTILLERY"

the board, the engine took over the job without hesitation and everything was in full blast.

The only physical change in the engine necessary to adapt it to its new fuel was to increase the combustion space and readjust the carburetor. The former was done by removing the head and introducing between it and the cylinder block a flat plate of cast iron about 1½ in. thick, bored to correspond to the cylinders and using two gaskets instead of one to remake the joint. The engine runs equally well with either gasoline or kerosene but, of course, loses some of its original "pep."

To maintain a constant speed for shop power purposes some kind of automatic governor was necessary and this, perhaps the most simple and ingenious device of the whole outfit, is shown in Fig. 2. A flanged bushing *A* is keyed and setscrewed to the protruding end of the crankshaft and bolted firmly to the flanged end is the bar B, made of two pieces of square cold-rolled stock and journaled at the ends to take the ring which acts as the governor weight.

The ring is the balance wheel of an old sewing machine. The spokes have been cut out and two holes drilled in the inner side of the rim into which the journals of the bar *B* are fitted. The rim revolves with the

engine shaft in a true circle but is free to swing out of a true plane, thereby becoming an ellipse. The tendency of the revolving rim is, of course, to swing into a true plane by virtue of the action of centrifugal force.

This action is resisted by the coil spring *C*, attached at one end to the inner end of the flanged bushing while the other is hooked over the notched post *D* that is driven into the rim. By moving the spring to or from the center of rotation along the line of notches the effective pull is diminished or increased; thereby adjusting the engine to any desired speed within its range.

A smaller crossbar *E*, bolted to the rim, carries an extension at right-angles which connects through the system of levers at *F* with the throttle. The piece *G* is a lead weight added after the device was complete, to bring it into balance.

The cooling system and water distilling apparatus consists of an old oil barrel, some pieces of hose, and the radiator of the Ford, all of which may be seen to better advantage in Fig. 3. The radiator is built into an opening in a wooden stack which extends through the roof of the shop and thus there is a natural draft of air passing through the radiator cells at all times.

After the engine has been running for a short time the water in the barrel becomes hot enough to throw off a vapor, and this vapor in passing through the radiator becomes condensed, the condensation dripping into the stone jar below. The distillery does not work very fast but its works all the time, without expense or supervision. There is always a supply of distilled water in the jar.

The accumulator will drive the shop for an hour if need be, but its real service, besides starting the engine, is to furnish current for lighting the shop and the proprietor's residence, adjoining, at times when the engine is not running. Standard 110-v. bulbs are used and the cost is nothing but a little extra kerosene and the very small amount of attention required by the accumulator. Direct current is also available at all times for recharging the small storage batteries of automobiles, which is a part of the proprietor's business.

When I expressed surprise at the presence of the wattmeter with no bills either payable or receivable to account for, he said: "Oh! I just picked it up somewhere and installed it to keep tabs on the engine. If she don't tread up the meter according to my figures I know she ain't earning her kerosene and I just start an investigation."

Erratum

Too late to make the changes on the original plate, we received from G. E. Katzenmeyer the accompanying chart which is a revision of Fig. 2 in the article "Strength and Proportion of Industrial Gears," on page 666 of our issue of May 4. Those readers who clipped the original article for reference should see that this chart replaces the incorrect one.

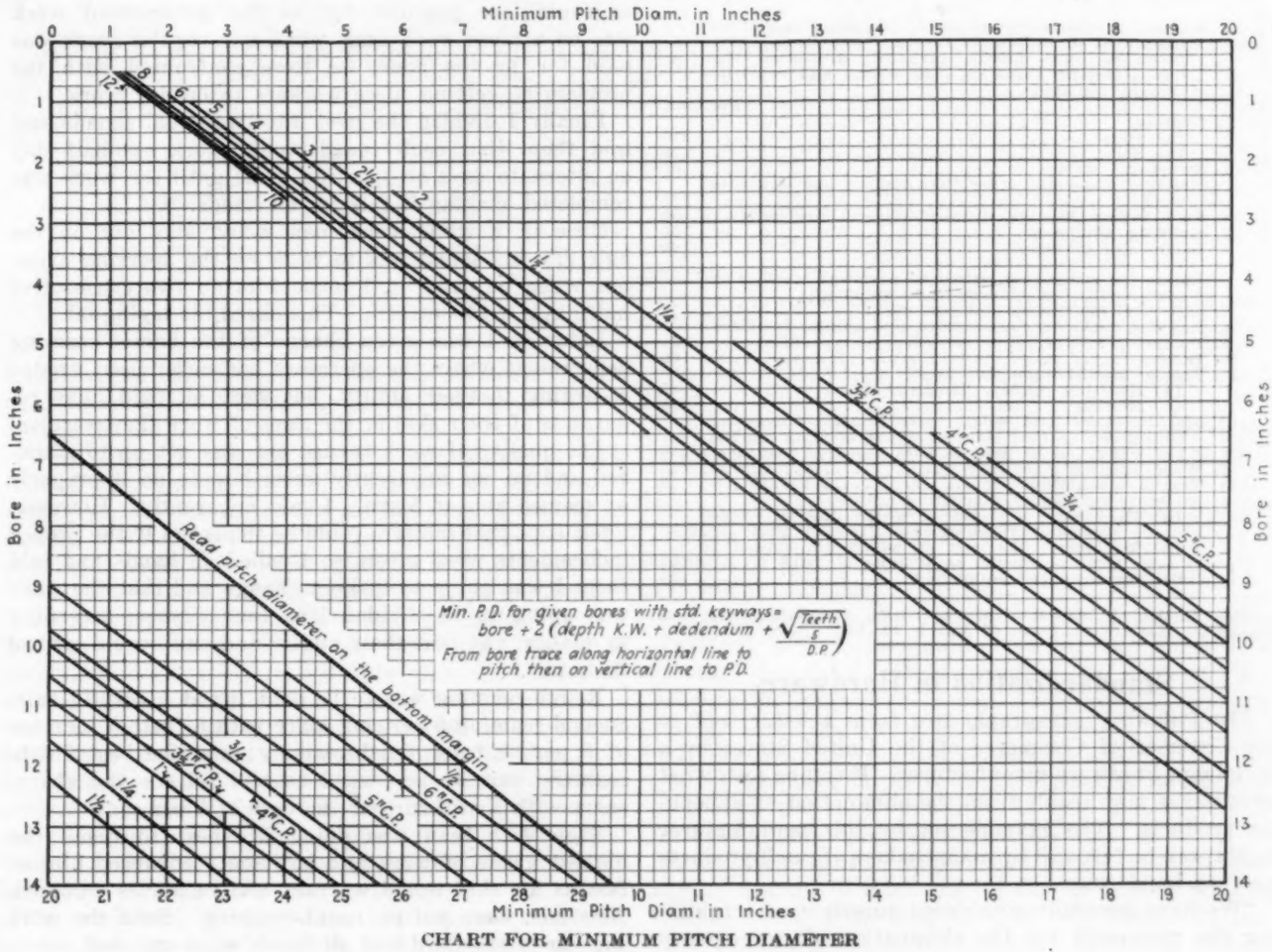


CHART FOR MINIMUM PITCH DIAMETER

Amortization of Plant Facilities*

Pursuant to Art. 184 of Regulations 62, the Commissioner of Internal Revenue has determined and publishes the following ratios of estimated post-war cost of replacement for use by taxpayers in computing claims for tentative allowance for amortization.

The purpose of establishing these ratios is to facilitate the preparation and examination of claims and to bring about, to such extent as may be practicable, uniformity as to the basis of claims. The allowances based thereon will be purely tentative and subject to redetermination in accordance with the provisions of the law.

These ratios, condensed as they are to cover sixteen groups, are necessarily composite figures, arrived at by an examination of many items entering into the respective groups, and it is realized that in some cases where only a limited number of items in the group are involved, the ratios given may not fairly be applicable to a particular case. In such cases the claim for amortization should be made in accordance with the ratios published, but the taxpayer, along with his claim, should submit a statement showing in detail the reasons why, and the extent to which, such ratio is not properly applicable to his claim, so that such cases may receive special consideration; in like manner, there may be cases where the ratios as applied to the particular claim would give the taxpayer more than a reasonable allowance, and in such cases the ratio properly applicable will be determined on the examination of the claim and the taxpayer given notice thereof.

All ratios are expressed in percentages based on prices as of June 30, 1916.

		Per Cent
A.	Ratios for computing estimated post-war cost of replacement of buildings, vessels, cars, tanks, blast furnaces, open hearth furnaces, annealing furnaces, electric furnaces, coke ovens, and construction of all kinds.	
1.	Lumber:	
	(a) Hard	240
	(b) Soft	175
2.	Structural steel	60
3.	Building materials, other than lumber and structural steel	225
4.	Steel (other than structural steel) and steel products	90
5.	Building equipment	150
6.	Labor (all classes)	160
B.	Ratios for computing estimated post-war costs of replacement of machinery and equipment.	
7.	Electrical machinery and equipment	130
8.	Engines, turbines, compressors, and similar facilities.	175
9.	Pumps	135
10.	Boilers	160
11.	Transmission equipment:	
	(a) Shafting, pulley, hangars, etc.	135
	(b) Belting	100
12.	Machine tools and small tools (machine tools are considered as that class of metal working machinery which can be used on *both* cast iron and steel)	130
13.	Wood-working machinery	155
14.	Textile machinery	155
15.	All other machinery (including cranes):	
	(a) Machinery, the cost of which did not exceed 10 cents per pound as of June 30, 1916	120
	(b) Machinery, the cost of which did exceed 10 cents per pound as of June 30, 1916	130
16.	Office furniture and equipment	125

*For further information in regard to Regulations 62, see AMERICAN MACHINIST, issue of March 30, 1922, page 482.

Standardization in Hardware

The following paragraphs are from a letter sent to the Chamber of Commerce of the United States by a prominent hardware manufacturer. It can be seen what advantages may result from the elimination of unpopular products. The example set by this manufacturer might well be followed by many makers of small products such as hand tools.

"We have generally considered ourselves as originating the movement for the elimination of unnecessary patterns, sizes and finishes, especially in the hardware field. We started this work ten years ago.

"We have cut our line of hammers, hatchets, axes, files and sledges down from 2,752 items to 761 items. We have done even more than this. We have concentrated nearly 90 per cent of our business into 344 of those 761 items. We have gone further along this line than has any of our competitors. Our whole industry responded willingly to the request first made upon them by the Hardware Manufacturers' Organization for War Service and followed up by the Conservation Division of the War Industries Board, but the industry as a whole has not gone as far as we have individually.

"Since the war some members of our industry have restored part of the items they dropped, but not many. We do not consider this any disadvantage to us. If they want to take action which we consider economically unsound, we feel that it puts them at a disadvantage in competing with us. It helps us to reduce our costs lower than theirs. It gives us a selling argument. It increases the strength of our selling argument to our distributors—that there is no dead wood in our line."

Handling Men

BY F. W. REARDON

During the late war the writer was in charge of straightening gun and rifle barrels in a gun shop engaged in the production of sporting arms. A contract was taken for rifles for the Government, and at the time we had a lot of unfinished sporting arms in the shop. It was thought advisable to finish this work up as rapidly as possible, but as the government work was on a piece work basis while our regular work was paid for by the hour, we were confronted with the problem of getting piece workers to do day work.

Finally I divided the men into two equal squads and told them that each squad would work one-half day on alternate days on sporting arms until the work was completed, making it fair for all hands.

Once in a while some man would stay out on the half day his squad was to work on the sporting arms, but when he came in I made him do two consecutive half day's work on them. This cured the laying off.

Later on I was given charge of the barrel reaming department where the operators had never been graded according to their ability, but were all paid alike regardless of their skill or the class of work they were on.

The quality of work turned out was not up to standard and no one apparently knew how to do it properly or seemed able to learn. I said apparently. However, I felt sure that matters could be improved if the proper inducements were given, so I called all hands and told them I was going to make a change and that the work was going to be divided into four classes, according to quality, and that their ability and skill would control their pay.

Rough-reaming was to be paid for at a certain rate. Second reaming 5 per cent more with a further increase of 5 per cent for finish-reaming; and the best finish-reamers were to be picked as tool setters and sharpeners with a still further increase of 5 per cent.

Soon each man was doing his best to reach the highest grade of work and pay and I advanced him as fast as his skill would warrant and vacancies occurred. New men were put on rough-reaming. Soon the work was up to standard and all hands were satisfied.

Ideas from Practical Men

Devoted to the exchange of information on useful methods. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. The articles are made up from letters submitted from all over the world. Descriptions of methods or devices that have proved their value are carefully considered and those published are paid for.

Turning Special Tapers

By Wilmer H. Bath

It is sometimes necessary to turn special tapers on the lathe, i.e., tapers of such angles and length that it becomes impossible to turn them with the use of the taper attachment or the compound rest.

This was the case recently in the shop with which the writer is connected. The angle in question was 19 deg. 20 min. included, and nearly 10 in. long. This angle we could not get with the taper attachment which has provision for a maximum angle of 15 deg., included and the travel of the compound rest was so small that it would have been necessary to reset the tool several times during the cut.

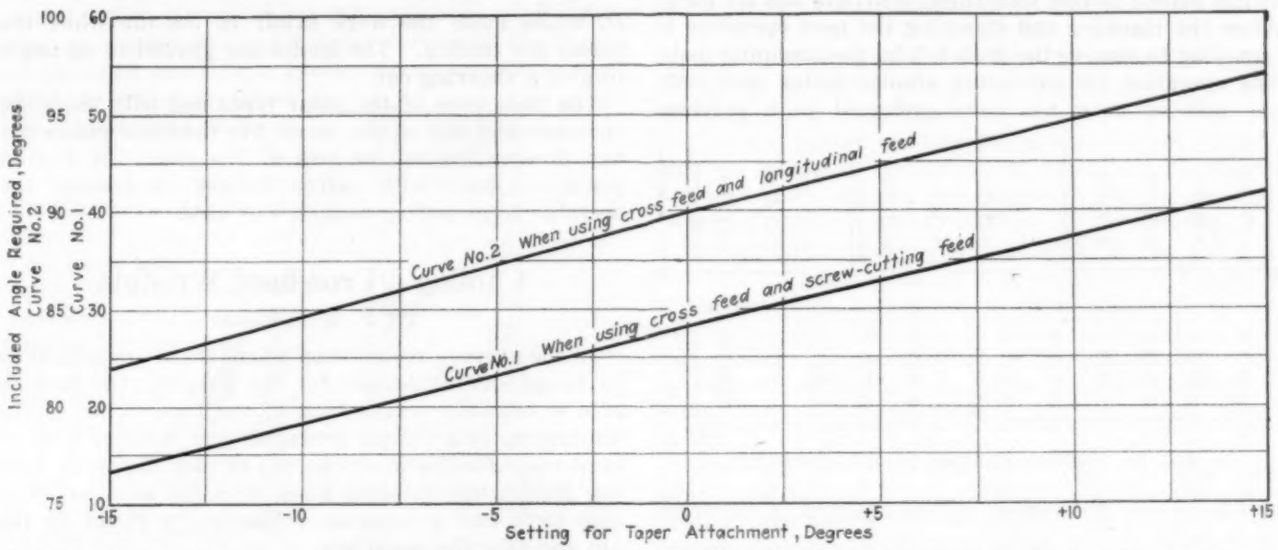
With these handicaps in mind we began to look around for a quicker method. The idea of any special apparatus was not acceptable as the time consumed in making it would have been greater than that required to do the job, since there was but one piece to be made.

We investigated the conditions on a 16-in. Hendey lathe to try and determine an easy set-up for the job. During this investigation it was discovered that it is possible to turn tapers on the lathe mentioned as noted by the accompanying curves.

By using the taper attachment alone we have found it possible to turn tapers up to and including 15 deg., and by using the longitudinal feed in combination with the crossfeed to turn a taper of 90 deg. included. By using the screw-cutting feed in combination with the crossfeed a taper of 28 deg. 4 min. 12 sec. included could be turned.

The endeavor, then, was to combine one of these set-ups for apron power feed, with the taper attachment, in other words, to vary the angles 28 deg. 4 min. 12 sec. or 90 deg., by an amount equal to that indicated by the setting of the taper attachment.

The action we get when using a combination of feeds, as mentioned, is that the taper attachment causes the crossfeed nut to move through a distance equal to the tangent of the angle to which it is set while the cross-power feed operates the crossfeed screw. Operation of either the nut or the screw causes the motion of the toolpost. In addition to this combined movement there is motion due to the longitudinal feed or the screw-cutting feed. The screw-cutting feed operates the carriage at a speed four times that due to the longitudinal feed.



CURVES OF TAPERS THAT CAN BE TURNED BY USING CROSS AND LONGITUDINAL FEEDS IN CONJUNCTION WITH TAPER ATTACHMENT

A word of explanation as to the derivation of the angles 90 deg. and 28 deg. 4 min. 12 sec. Since the ratio of the longitudinal feed to crossfeed is 1:1, we have two equal values representing the adjacent side and the opposite side of a right-angle triangle. This gives a tangent of 1, or an angle of 45 deg. Doubling this, we get 90 deg. included.

Similarly, since the ratio of screw-cutting feed to crossfeed is 4:1, we again have the two sides of a triangle and taking the tangent of the angle we get 0.250 or the tangent of 14 deg. 2 min. 6 sec. Doubling this gives 28 deg. 4 min. 12 sec. included.

If the screw-cutting and crossfeeds are used and the taper attachment set to 15 deg. included, it would seem as though the angle would be 43 deg. 4 min. 12 sec. included. This, however, is not the case as the cross motion would be the sum of the tangents of the two angles, 7 deg. 30 min. and 14 deg. 2 min. 6 sec., or 0.38165 which is the tangent of 20 deg. 53 min. 21 sec. This, doubled, gives an included angle of 41 deg. 46 min.

42 sec. This, no doubt, will explain the origin of the curves shown. Taper attachment settings are noted as plus or minus. Plus indicates motion toward the operator and the lathe spindle, and minus indicates away from the operator and toward the lathe spindle.

Since any combination of feeds through the apron gives motion of the tool toward the operator when the carriage is moving toward the spindle, or away from the operator when the carriage is moving toward the tailstock, it will be observed that it was necessary to use a negative setting of the taper attachment as the work had to be held by the small end for boring.

A feature of the boring job was that we reversed the direction of the lathe spindle and used a tool forged left-hand, or opposite to a regular boring tool, the cut being taken on the back side of the bore.

Tools for Trimming Electric Push-Button Switch Plates

BY GEORGE WILDER

In Fig. 1 are shown five sizes of electric push-button switch plates, namely two, three, four, five and six gang. After the blanking and stamping the next operation is trimming to remove the flash left by the stamping tools. The operation for producing similar plates with only one pair of holes has been explained in a previous

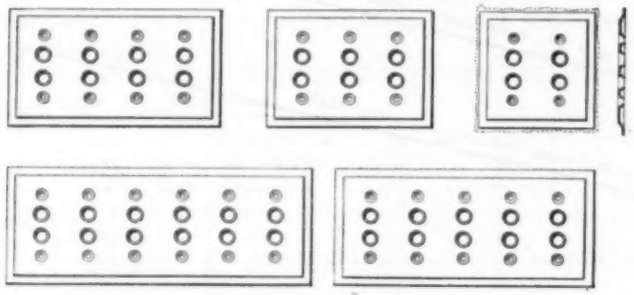


FIG. 1. SWITCH PLATES TO BE TRIMMED

article so this description will be confined to the trimming tools.

Because of the very thin metal it would not be good practice to try to push the plates through a die, as this procedure would cause the metal to buckle and leave small kinks that would be next to impossible to remove and often invisible until after the plates are buffed. Also if a clipping die were made for each size it would necessitate five sets, and the cost would be very high.

As orders for the large sizes of plates call for comparatively small quantities, the large tools would hardly be a paying proposition, therefore a set of tools, simple in design, was built to clip all sizes of plates at a total cost of little, if any, more than the cost of one big set.

One objection offered to this method of handling all sizes with one set of tools was that each plate would have to be handled twice, as only two sides could be clipped at once, but it was shown that even with this handicap it would take over five million plates (clipped four sides at once) to pay for the five sets of tools and their upkeep. Therefore the set shown in Fig. 2 was built and operated successfully at a cost one-third under the estimate.

The operation of this set of tools is as follows: The plate is placed on the die, being located by the stamped contour fitting over the corresponding nest, and as the press descends the blade *A* clips the front side while the blade *B* clips the right-hand end. The piece is then reversed to clip the remaining sides.

In the punch holder is a pad *C* backed by the springs

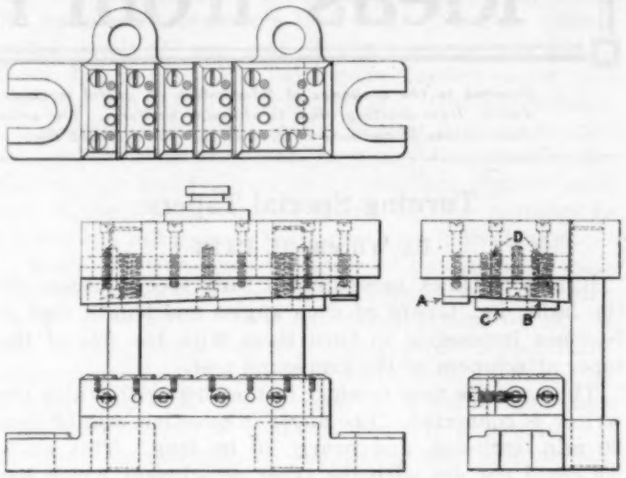


FIG. 2. THE TRIMMING TOOLS

D, which holds the work firmly in the die while the blades are cutting. The blades are ground to an angle to give a shearing cut.

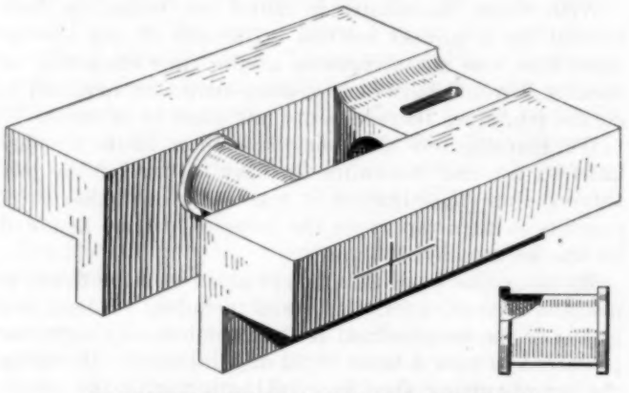
The tools were of the pillar types and with them the operator was able to clip about five thousand pieces per day, irrespective of the size of the piece. A Farrell press, equipped with safety devices to prevent the operator from getting caught, was used.

Chilling a Crosshead Wristpin

BY F. M. A'HEARN

In the average repair shop where there are seldom to be found special devices for the purpose, the turning of a wristpin in a crosshead of the type shown in the illustration is a tedious operation and involves a lot of hard labor for the man who has to rock the work back and forth while the lathe hand, with the usual array of bent tools and goosenecks, endeavors to round up the pin and face the shoulders.

Such a crosshead was needed for a 17 x 24-in. locomotive and, as is usually the case, the engine was being held out of service until a casting could be made and machined. To reduce the time and labor required we decided to try casting the pin in a chill.



CROSSHEAD WITH A CHILLED WRISTPIN

The gray-iron bushing shown at the right of the sketch was made to the required dimensions as to length and bore, leaving a wall of about $\frac{1}{8}$ in. It was

then thoroughly coated with graphite to prevent the molten metal from adhering, and placed in the mold. When the casting had cooled, the shell of the bushing was easily broken away and we found the bearing parts to be in satisfactory condition.

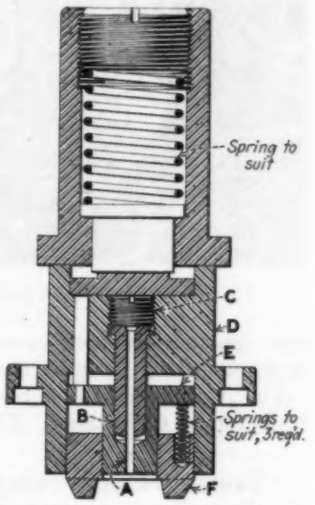
To lay out the casting for finishing so that the pin would be square with the planed surfaces we placed the pin in a V-block with the crosshead in a horizontal position and scribed the lines as indicated upon the outer surface. Raising the crosshead to a vertical position the cross lines were laid out and centers established, from which we were able to plane and finish the casting with the pin in proper relation to the guides.

The job proved to be satisfactory in every way and the labor of finishing the pin was saved, thus reducing by that amount the time that the locomotive was out of service.

Tool for Locating Watch Wheels for Piercing Center Hole

BY I. BERNARD BLACK

In the manufacture of watches there are many operations, especially the blanking and piercing of the escape, center, third and fourth wheels, which may cause a lot of trouble in the time keeping. Sometimes this is due to the wheels being blanked out of round, or to the holes being pierced at one side, the latter cause being most often the case. When the holes in the wheels are not central, a lot of friction is developed in the train and the watch naturally stops. The wheels causing this trouble have to be replaced, of course, with wheels that are absolutely perfect as regards concentricity. In many cases ingenious methods have been devised to correct this fault and most of them have proved successful.



LOCATING AND PIERCING TOOL FOR WATCH WHEELS

In the illustration is shown a method adopted recently for accurately locating watch wheels to be pierced. Part *A* is the piercing punch, which is lightly driven in the holder part *B*, the upper part being riveted over and backed up by the setscrew *C*. The holder part *B* is a drive fit in the main holder part *D*, and a sliding fit in part *E*, which in turn is a sliding fit in parts *D* and *F*. Part *F* is a sliding fit in part *D*, and is attached or rather held to part *D* by two screws. The action of the holder is as follows:

When the ram descends, the bell-mouthed piece *F* centers the wheel in the die, and recedes into part *D* until part *E* presses down on the wheel in the die, thus firmly clamping it while the piercing operation is done by part *A*. On the upward stroke of the press parts *E* and *F* spring back to their relative positions, the operator takes the pierced wheel off the die and is then ready to pierce another. Centralization of the hole is thus secured, and with a die that will punch a truly round wheel, very accurate work is produced.

Making Long Screws

BY R. G. HOGG

On page 132 of AMERICAN MACHINIST, L. J. Grinnell outlines some very elaborate methods of making and transporting two guide screws 64 ft. and 74 ft. long, respectively.

The factory situated next door to the one where I served my time, and later where I served two years, had a regular habit of making such screws 64 ft. and 68 ft. long every few days.

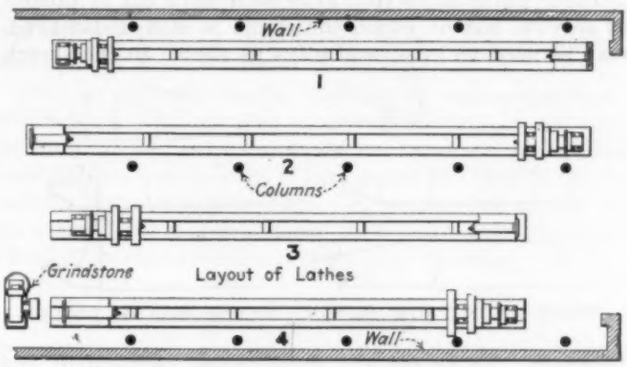


FIG. 1. ARRANGEMENT OF THE LATHES

First the turner would select a bar of steel, drag it over the cobbles by divers means, center it with the aid of about three helpers and juggle it into position between the lathe centers. After the thread was cut, came the puzzle how to reverse ends in the lathe to finish a thrust bearing on the other end. The shop was about 75 ft. long and 30 ft. wide and freely dotted with columns to support the second story which contained about 40 small lathes. The ground floor contained four large and long lathes and one pre-historic grindstone, the arrangement of the tools being shown in Fig. 1.

Now I am wondering how the Driggs Co. turned the screws end for end. The enclosed crude diagrams will explain how we turned them. The short ones were transferred from No. 1 lathe to No. 2. The extra long ones were machined on lathe No. 2 (the longest in the shop) and had to be jockeyed on two or three small four-wheel trucks around the block to be turned and then brought back to the lathe. The route taken can be seen in Fig. 2.

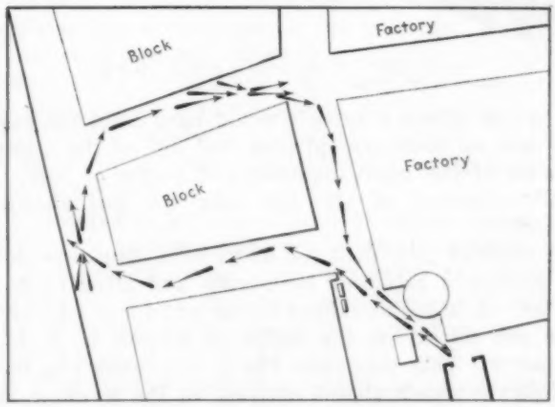


FIG. 2. SWINGING THE LONG SCREWS AROUND THE BLOCK

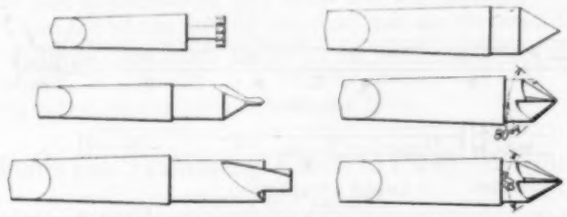
William, or "Old Bill," who is not yet sixty has

been making these screws for over twenty-eight years and as for transportation troubles, after he was through with his part he didn't give a whoop, but we never had any complaints to my knowledge.

Uses for Discarded Taper Shank Drills

By Frank C. Beere

Taper shank drills that have been worn out or broken in service, but of which the shank is still undamaged, may be used up in several ways as shown in the sketch



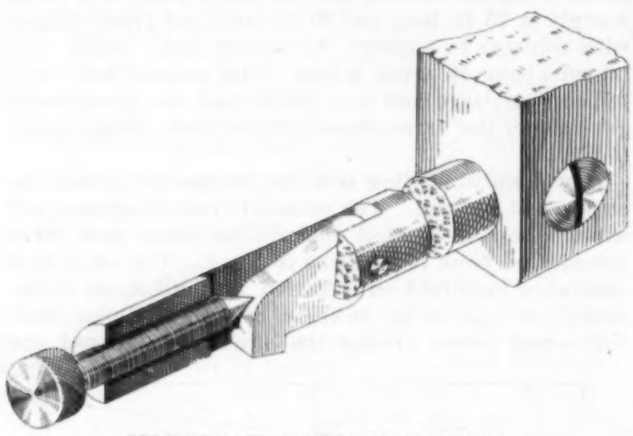
TOOLS MADE FROM BROKEN TAPER SHANK DRILLS

herewith. Lathe centers, combination center-drill and countersink, counterbores, end mills, Woodruff key-cutters, and many other similar tools may be made from these odd bits that are usually thrown away.

Cutting a Keyway in a Small Bushing

By Clarence B. Coe

A job that caused us considerable trouble was the cutting of a keyway $\frac{1}{8}$ in. wide by $\frac{1}{16}$ in. deep in a bushing 3 in. long and of $\frac{1}{4}$-in. bore. As there were



SPLINING TOOL FOR SMALL HOLES

but a few pieces a broach would have been too expensive and an ordinary splining tool out of the question because of the small diameter and length of hole. We finally disposed of the job with the tool shown in the cut.

A piece of $\frac{1}{4}$-in. drill rod about 5 in. long was slotted by drilling a series of $\frac{1}{8}$-in. holes and filing to fit the cutter. A hole was tapped in the end for a $\frac{1}{8}$-in. screw. The pin on which the cutter is hinged is $\frac{1}{16}$ in. in diameter. This may seem like a very weak pin, but as the strain comes almost entirely on the screw, a small pin will stand up and will not weaken the bar as much as a larger one.

The cutter was made of $\frac{1}{8}$-in. stock cut out to about the shape of the sketch. The screw is a stock screw with a 60-deg. point. The bar is held in a tool having a $\frac{1}{4}$-in. crosshole near the end.

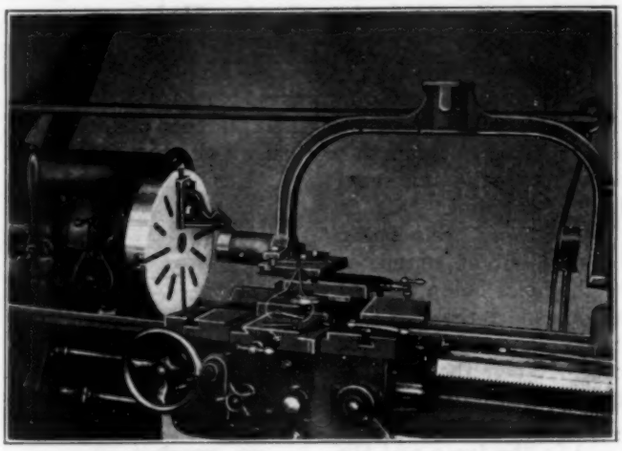
The device was used in a shaper with the apron clamped down, as the cut comes on the back stroke. The tool came forward, the screw was given a slight turn, which forced the cutter out at each stroke.

A Large Job in a Small Lathe

By S. J. Morgan

The illustration shows how we turned the trunnions on a yoke for a concrete mixer, in a lathe much smaller than would have been required to swing the piece. This yoke was 48 in. long and the distance from center to outside was such that it would have required a 48-in. lathe to swing it. We used an 18-in. lathe.

Little explanation is required. We made a bracket to hold the toolbit and fastened it to the large faceplate of the lathe. One end of the work was bolted to the wings of the lathe carriage and the other was supported by the tail center, the foot stock being coupled to the



A LARGE JOB IN A SMALL LATHE

carriage and left loose upon the shears so that it would be drawn along later by the movement of the carriage.

The turned portions of the hubs were $3\frac{3}{4}$ in. in diameter by $6\frac{1}{2}$ in. long. The time was about one hour.

Testing Connecting Rods—Discussion

By Gus Haessler

The method of setting up for testing connecting rods described by G. A. Luers on page 382 of American Machinist, is a satisfactory one; but the use of a surface gage and scriber for the purpose is justified only when no better means are at hand, or when only one rod is to be tested, since the scriber does not register.

Any one of the small dial indicators now on the market may be attached to a surface gage or to a height gage by means of small C-clamps that may be purchased for little cost. Assuming that the wristpin and the mandrel in the connecting rod are true cylinders and are parallel to the surface plate, a dial indicator would show it by registering the same at both ends, while if they were not parallel the dial would indicate in thousandths of an inch the amount of error.

In testing work of the kind under discussion a height gage and dial indicator is preferable, and the latter may be attached to the scriber, or, by removing the scriber and yoke, it may be attached directly to the sliding jaw with one of the small clamps mentioned above. The indicator may be attached in a moment and with this combination the job may be done more conveniently.

Editorial

Getting and Using Trade Information

THERE are many indications that trade associations are destined to play a big part in the success or failure of individual businesses in any industry. This does not mean price-fixing associations, which are not likely to be tolerated under any circumstances, but associations which will study business conditions more thoroughly than can be done by any except the largest of individual concerns.

Anyone who endeavors to find accurate and comprehensive data concerning almost any industry will be amazed at the difficulty and at the meagerness of the facts he is able to muster. How many know the number of firms engaged in their own line of work, the total output in machines, the variety of shops which utilize them, or similar data? How many have any data, accurate or otherwise, as to markets for special machines?

Information of this kind can be satisfactorily collected and digested only by a well organized association or a government department. The latter, not necessarily through any fault of its own, is usually very slow. The strong trade association is in the best position to do this and to distribute the information promptly. The feeling seems to be growing that in either case the information must be made public, thus giving the greatest advantage to those who use it most intelligently.

There is, unfortunately, no sure way of getting these data into the minds of those who need them. Until business men realize that accurate, last-minute information of their industry is more vital to them than the stock market or the baseball score, industry and the country at large suffer, not to mention their pocketbooks.

An unopened and unread business paper on a manager's desk is an admission of inefficient planning of his working day. A study of the bank balance may have a more pressing appeal but, unless he also studies his industry as outlined and laid before him in his business papers and trade association bulletins, he may not have any bank balance to study.

Problems in Business Revival

THE hopes of those who had an abiding faith in the future of the country are beginning to be realized. Business is coming back, especially to those who go out and get it. Those who have decided that it cannot come before fall will probably find that to be true—for them. But when fall comes, they will be several laps behind those who go after business now.

Only the short sighted, however, will dream that their troubles and anxieties are over because business revival is under way. In reality they may have just begun. Not anxiety as to meeting the payroll and keepin the sheriff away, perhaps, but anxiety as to being able to manage the business so as to have it occupy its proper place in the industry.

The real manager must continue to look ahead, to build for the future as well as for the present, not in enlarging plant facilities, in many cases, but in manufacturing and sales methods and in both trade and industrial relationships. He will avoid price juggling so far as possible, as nothing is more fatal to steady business or the confidence of customers.

This is contrary to the doctrine of some economists who advocate an advance in price for every increase in demand. Practical considerations, however, make this inadvisable, especially at a time when business is on its painful way back to normal. Price changes should be as infrequent as possible as they shake confidence in stability, and confidence is especially desirable now.

Spiral or Helical?

IF YOUR hands were tied, could you explain the difference between a spiral and a helix? We think this a pertinent question, because movements of the arms seem to be necessary to the average individual in explaining the shapes of these curves. Because of the fact that the two terms are used so frequently in present-day practice, the difference should be well understood.

Before offering a definition, we might attempt to clear our way a bit by stating that we propose keeping to the real mathematical meanings of the terms. True, this action conflicts a bit with the ideas that are entertained by many a good mechanic and engineer. What is more, it conflicts with such authorities as Webster and many standard handbooks.

The confliction is justified, however, by the fact that the men engaged in a field requiring the accuracy of both thought and workmanship that building machinery entails, have need for the most mathematically correct nomenclature, as well as formulas. There is no wisdom in applying two terms interchangeably to two different things; we have need for a specific name for each. The tendency is all toward the precise usage of the terms spiral and helical, and eventually handbooks will not present them as synonyms.

Using the term in a mathematical sense, a helix is that curve formed on a cylinder by a straight line lying in a plane that is wrapped on the cylinder. The best practical examples are ordinary screw threads, worms and some types of reamers. A spiral, however, is the curve developed by a point moving about another point and continually receding from or approaching it. This type of curve is well exemplified by watch springs and scroll plates.

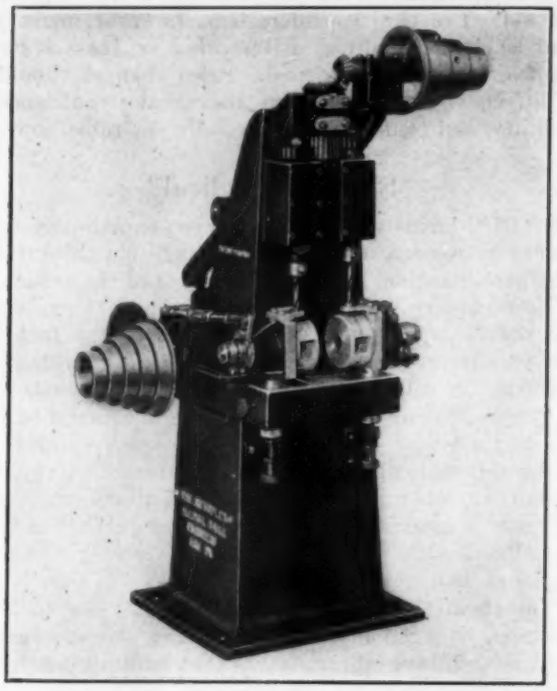
The difference between the two curves might be summed up in this way: For the spiral, the point about which rotation occurs is fixed, while for the helix it advances along a straight line. Furthermore, the radius to the revolving point continually increases for the spiral, but is constant for the helix.

The shop man wishes to be correctly informed and up-to-date on matters of nomenclature. However, he certainly cannot be blamed if his ideas are incorrect on this subject, when so frequently management does not give it sufficient consideration. Pay attention to the use of the terms, so that they are accurately applied, particularly when naming a tool or an operation.

Shop Equipment News

Barr "Autoplex" Drilling Machine

An automatic duplex drilling machine, designated as the "Autoplex," has recently been placed on the market by H. Edsil Barr, Erie, Pa. The machine, shown in the



BARR "AUTOPLEX" DRILLING MACHINE

accompanying illustration, is intended for high-speed drilling, reaming, facing, polishing and such operations on small parts made in large quantities.

There are two spindles mounted on the face of the column, each spindle rotating in a square guide block or quill. Noiseless gears at the upper ends of the spindles transmit power from the drive pulley. This pulley has three steps, so that the speed can be adjusted to suit either high-speed steel or carbon-steel cutting tools. The feed and the work chuck are operated by a separate five-step cone pulley mounted at the rear. One countershaft carries cone pulleys to drive both the pulleys on the machine.

The camshaft is mounted at the rear of the machine and geared to the cone pulley that drives it. It carries two pairs of cams, one for each spindle unit. Each large cam has a follower running on it and pivoted at the back of the frame; one of these followers can be seen at the left of the machine in the illustration. The end of the lever arm toward the spindle has a gear segment cut on it that meshes with a rack on the square spindle quill. The rise on the cam is uniform, so that the spindle feeds downward evenly. It has a quick drop, however, so that the spindle returns rapidly after the cutting stroke. The cams are so set that the spindles operate alternately.

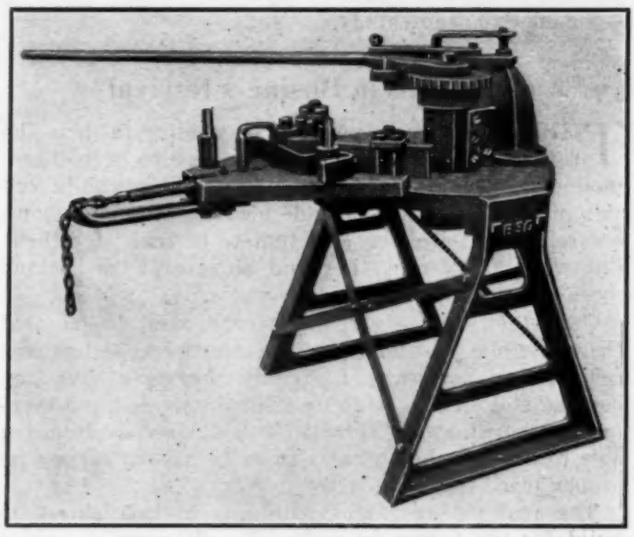
At the end of each camshaft is an internal cam connecting by means of a tie rod to the work-holding fixture. Each fixture head has four pockets to hold the work. The head is rotated one-fourth of a turn after each rise of its spindle. The rotation occurs when the internal cam pulls the side rod toward the rear. The forward movement of the side rod is without effect on the head, as this motion simply places the dog in position to rotate the head another quarter turn. The head is automatically locked in place while the drill is cutting. The position of each work head can be adjusted vertically by means of the handwheel beneath the head.

Ordinarily the work is carried on a sheet-metal container, and the operator feeds one head with each hand. The machine then does the drilling automatically and drops the parts into chutes leading to tote boxes placed at the rear. The heads are removable, so that special fixtures can be mounted. The machine can handle drills or reamers up to $\frac{3}{8}$ in. in size.

Bussel Universal Bending, Forming and Shearing Machine

A machine for bending, forming and shearing metal has recently been placed on the market by the Bussel Machine Co., El Paso, Texas. The machine is hand-operated and furnished in three sizes. The smallest size is intended for bench mounting; the medium size or No. 2 machine has only one bending post and no shearing plate or compound ratchet. The machine illustrated is the No. 3 size, is equipped for forming and shearing and has a compound ratchet lever.

No extra dies are required to bend any size of stock within the capacity of the machine. The stock is securely held so that it does not slip, no matter to what angle the bend is made. The machine operates either right- or left-handed and is operated by one man. The compound ratchet is not used for light work, the post



BUSSEL NO. 3 BENDING, FORMING AND SHEARING MACHINE

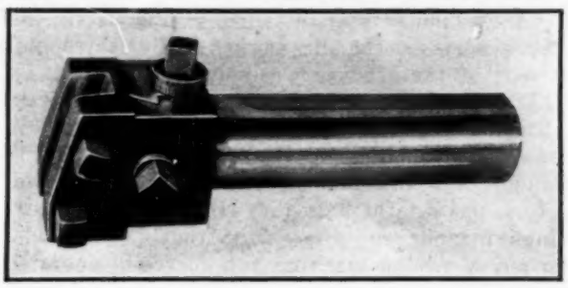
being equipped for direct pull. The work can be easily removed, although bent in the form of a complete square or circle.

Small holes in the table permit of adjustment of the attachments to the position desired. When the forming and shearing plate is removed, all sorts of work, particularly heavy bending, can be handled. The bending post has four edges and makes less than a quarter turn in producing a 90-deg. angle. Stock larger than can be placed in the bending post edge-wise, can be bent on the outside of the post. A 90-deg. angle can be bent accurately without the use of a square.

The No. 3 machine has two bending posts, one for light and one for heavy work. The small post permits of bending cold ½ x 6-in. and ⅞-in. round or square steel, and ⅝ x 6 in. with a sharp corner hot. With the large post, ¾ x 6 in. can be bent cold, 1 x 6 in. with a sharp corner and 1⅜ x 6 in. with a round corner when hot, and pipe up to 2 in. in diameter. The No. 3 machine weighs 840 pounds.

Warner & Swasey Adjustable Angle Cutter Holder

An adjustable angle cutter holder for use on turret lathes has recently been brought out by the Warner & Swasey Co., of Cleveland, Ohio. The purpose of the device is to eliminate uncertainty in adjusting cutters to close limits; an adjustment as small as 0.0005 in. can be made. A graduated adjusting screw operates a small cutter slide. The lock screw is ordinarily drawn up lightly and kept in that position, so that the adjustment can be made without changing the tension of the screw.



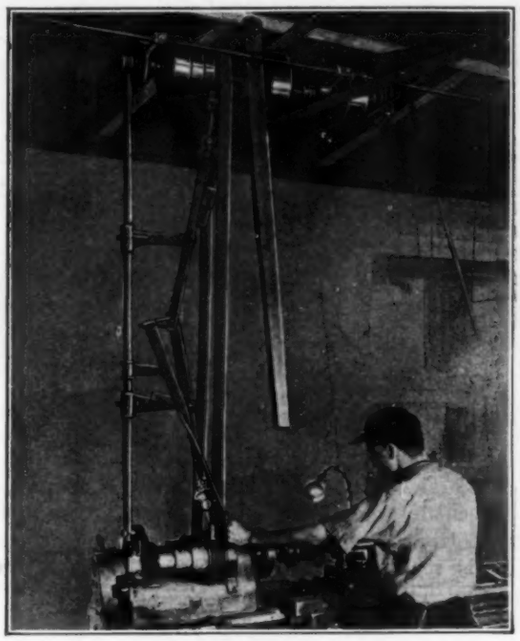
WARNER & SWASEY ANGLE CUTTER HOLDER

When turning to accurate size with a cutter head, at least two cuts must be taken over the surface. The roughing cut should be held within limits of 0.004 in., which can easily be done with a common toolholder by tapping the cutter lightly with a hammer. The finishing cut, however, requires considerable skill in adjusting the tool, to prevent moving the cutter too far and spoiling the work. The adjustable angle cutter provides a positive means of accurately setting the tool, so that the work can be easily turned to the proper diameter in the finishing cut.

The head is made of hardened steel. It is sufficiently strong to enable obtaining the same size on each piece, no matter if the conditions of operation be severe. In addition to obtaining the original setting quickly and easily, the exact size of the work can be maintained as the cutting edge wears down and as the machine warms up. It should be noted that cutter wear takes place especially on the first few pieces machined after grinding the cutter.

Kleckler Belt Shifter

In the accompanying illustration is shown the Klecker automatic device for shifting a belt on cone pulleys. The device has recently been placed on the



KLECKLER BELT SHIFTER APPLIED TO LATHE

market by the Keuka Industries, Inc., Hammondsport, N. Y. It is intended for use on all machines operated by belts running on cone pulleys, and it enables the speedy changing of the belt from one step to the other. Its principal feature is the fact that the belt does not slacken to a great extent during the shifting and does not permit of too much slowing down or actual stopping of the machine. Only one hand is necessary to operate it, and the operator can continue to give his attention to the work while shifting the belt.

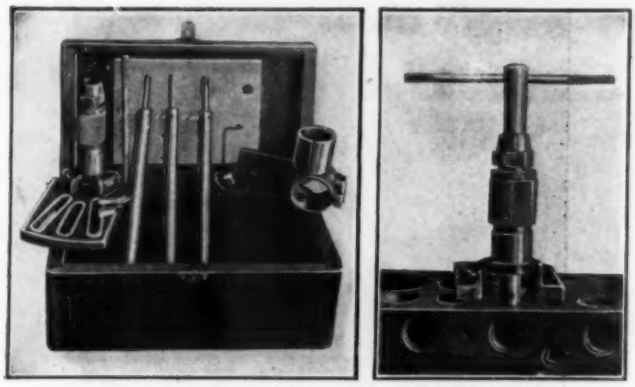
A loop fits the belt at both the countershaft and the pulley of the machine. Near each end of the mechanism is a weighted pendulum pivoted to the outer ends of the belt actuating levers. Gear teeth on the lever ends so mesh that pressure is exerted on the belt at that pulley on which the move is to be made from the lower to a higher step. The pendulums accelerate the action of the shifters. The belt directing loops are so pivoted that their sides remain parallel with the belt for all movements. This action prevents roughing and wearing the edges of the belt during shifting, so that its life is prolonged.

Steel lacings can be employed, since it is not necessary for the operator to touch the moving belt with his hands. The belt can be shifted almost instantaneously from one pulley to the other, or can be moved across the entire range of five speeds without appreciable stop on any one. It enables the machine operator to quickly attain the necessary speed for any operation, without the necessity of moving from his position in front of the work.

The device can handle belts from 2 to 5 in. in width on any standard machines. It can be applied to most lathes by securing it under the rear cap bolts. For especially long and heavy belts, heavier pendulums are provided.

"Davis" Valve Re-seating and Boring Tool

The Hinckley Machine Works, Hinckley, Ill., has placed on the market the "Davis" valve re-seating and boring tool for use on cylinder blocks of automotive



"DAVIS" VALVE RESEATING AND BORING TOOL

engines. The tool in operation is shown on the right side of the accompanying illustration. It will be noted that the cutter bar is not guided by only a small pilot at the bottom, but a large bearing above the valve seat holds it in place. This bearing is in a plate or holder that is clamped to the top of the block to be machined. The bar is inserted in the holder and the cutter put in place at the bottom of it.

The cutter bar is turned by hand. The side thrust is taken by the holder so that the seat is accurately cut. Feed is provided by a screw, so that digging-in, chattering or sliding over the surface is prevented. The cutters are lathe tools made of high-speed steel.

The tool will re-bore valve ports to a larger size, so that bigger valves can be employed. In renewing or enlarging ports, the contacting surface on the valve seat can be made narrower. This surface usually becomes widened after continual use and grinding so that carbon is apt to injure the seat.

The set consists of three boring bars, with $\frac{1}{4}$, $\frac{3}{8}$ and $\frac{7}{16}$-in. pilots, two valve seating cutters, one knurled handle to turn the cutters, two boring cutters, and a wrench for a hexagon setscrew. An attachment is provided for handling the valve cages of Buick motors. The parts are inclosed in a wooden case, as shown at the left of the illustration. The total weight is 18 lb., or 25 lb. when boxed for export.

A General Method for Spring Design—Discussion

BY A. J. STRONG

The article under the above title by Joseph Kaye Wood, on page 757, Vol. 55, of AMERICAN MACHINIST, brought to my mind some experiences I had with springs twenty odd years ago while with the Western Electric Co. at West and Bethune Sts., New York.

At that time the Western Electric Co. made apparatus for the Western Union Telegraph Co., and decided to tool up for telegraph keys to show costs which would enable it to get this business which other concerns were getting on price. These instruments had a cast brass base with the key posts or uprights cast integrally. It was decided that these bases could be made at a cheaper rate and more neatly if they were punched from sheet brass and if the edges were finished by die shaving.

This new method was also applied to the key, which consisted of steel about $\frac{1}{8}$ in. in thickness, and 6 in. in length, and made quite a heavy job as compared with the run of press work we had been doing. It was on the dies for the key that we had our troubles with the springs.

We designed and built for each piece, four post sub-presses, placing the punch at the bottom, with shedders to push the punching back into the stock. The available press was rather limited in height for die room, so there was not space enough to work in springs of the length we preferred. For pushing out the punching we placed in the top member three springs of square section, making these of bar stock by cutting a thread on the outside and then boring out the inside until the spring section was equal or exactly square. The thread, of course, had been cut with a square tool. After tempering, these made very good springs.

Things progressed nicely until we placed our key job in the press to try it out, and then much to our sorrow we found that there was not push enough in our shedder springs to force the punching out of the die. We screwed the springs down to the limit and still they would not shed the punching as intended.

We pulled the job down and after a council of war decided to make an additional set of springs in the same way the first set was made, but with an outside diameter which would allow them to drop freely inside of the first set. It was further decided to make the holes in the second set small so the spring section would be rectangular and give more power. After this second set of springs was installed, giving us six instead of three springs, the die worked without trouble and that part of the problem was solved.

That was many years ago, as man's life is measured. As I look back to those rough days of the "rule of the thumb" methods and as I read the article by Mr. Wood, I thought how fine it would have been if we had had the formulas set forth by him from which to figure the springs for our sub-presses, so that they could have been placed in the machine and correctly operated the first time.

I have had some experience with formulas and systems in use at the present time, which fail to function if slightly overloaded, and which are presumed to be of assistance to business, and when I read Mr. Wood's article it occurred to me that possibly it may at least, in a general way, represent some of the ills from which present-day business is suffering.

Grinding Automobile Crankshafts

On page 505 appeared the statement: "for grinding a high tensile strength steel an aluminous abrasive is recommended, while a carbide of silicon wheel is suggested for low tensile steel. It is the physical and not the chemical properties of the *wheel* which are to be considered." In the last sentence the word "wheel" should read "metal."

Usually a silicon of carbide wheel is selected for low tensile strength material such as cast iron, chilled iron, brass, aluminum, marble, granite, etc. All steel is of such high tensile strength, relatively speaking, that it is best ground with grinding wheels made with aluminum oxide abrasives.

News Section

Change in Agricultural Appropriation Bill

The conferees on the agricultural appropriation bill in their report to the Senate and House state that they have stricken out the language proposed by the Senate appropriating $10,000 for the study of standardization of farm machinery. This language was to the effect that the investigation should be by the Department of Agriculture in co-operation with the Bureau of Standards of the Department of Commerce.

Railroads Report Fewer Freight Cars in Use

Freight cars idle because of business conditions totaled 529,884 on April 23, compared with 491,513 on April 15, or an increase of 38,371, according to reports just received from the railroads of the country by the Car Service Division of the American Railway Association.

Of that total, 371,764 were surplus freight cars, that is cars in good repair in excess of current freight requirements, while the remaining 158,120 were freight cars in need of repairs in excess of the normal number unfit for service.

Surplus coal cars totaled 229,892, an increase since April 15 of 41,974, while an increase within that period of 827 was reported for coke cars which totaled 3,669. Surplus box cars numbered 98,406, which was a decrease within approximately a week of 280 cars. Reports showed 16,114 surplus stock cars, which was a decrease of 3,317 since April 15 and miscellaneous cars also showed a decrease of 478 within the same time.

Indiana to Buy Road Machinery

The Indiana Highway Commission will soon purchase a quantity of road maintenance machinery. The machinery will be used largely to repair the damage done by floods over virtually every section of the state. The commission is asking for bids on from one to four portable stone crushers, with a capacity of 10 to 20 cu.yd. an hour; one to ten portable screening plants; one to three tar kettles of 100 to 200 gal. capacity; one to fifteen road rollers of the three-wheel variety and 10-ton weight; forty to one hundred and fifty wagon screens; six to twenty-five concrete mixers; ten to twenty road graders and two to four contractors' plows. The commission also will purchase from 100 to 200 drag scrapers and from fifteen to thirty-five wheel scrapers for use in excavating.

Thousands of dollars worth of public property was destroyed by the recent floods and the state is taking immediate steps to rebuild roads, bridges, wharves and dams.

European Conditions Main Topic of U. S. Chamber Meeting

The main topic of the tenth annual meeting of the Chamber of Commerce of the United States will be "European Conditions and Their Effect upon American Business." This meeting will be held in Washington, D. C., May 15 to 18.

Discussion of manufacturing questions will take place at two group sessions, which are being arranged by the fabricated production department of the National Chamber. The lowering of costs and stabilizing of production is a subject which will attract manufacturers to the first group session. This subject will be handled by a large manufacturer whose name will be announced later.

Another step in the reduction of economic waste will be taken by the discussion of simplifying variety and standardization. This subject will be presented by W. A. Durgin, of the Department of Commerce. An interesting report of cut-outs made in nearly fifty articles of common use will show the trend of this kind of economy.

Uniform methods of cost reckoning as an aid in expediting production is to be discussed by a Western expert who will show how it can be done.

The practical study of business cycles to increase continuity of employment is the subject with which Wesley Claire Mitchell, an economist of national prominence, will deal.

On the second day group meetings will discuss manufacturing problems as they relate to the general subject of the meeting.

This naturally divides itself into two principal divisions, the manufacturing situation in Europe and the importance of foreign trade to domestic production.

The merchant marine committee of the chamber was asked to examine the Hague Rules and report its conclusions. This committee has now presented a report in which it states that the Hague Rules represent an important step toward the definiteness and uniformity which are important both for shippers and ocean carriers and they should be supported.

The question of endorsement of the Hague Rules will be placed by the directors before this meeting for consideration and such action as the chamber may think appropriate.

Bill for 8-Hour Day

Senator Moses, of New Hampshire, has introduced a bill in Congress to establish the 8-hour day, effective Jan. 1, next, in mines, quarries, mills canneries, workshops, factories or manufacturing establishments whose products enter interstate commerce. Violation of the law would subject the offender to a fine of not less than $100 and not more than $1,000, or imprisonment for one year or both.

Loans to Aid Export Trade Paid Back

The War Finance Corporation has announced that the advance of $5,000,000 to the Baldwin Locomotive Works, Philadelphia, Pa., made on Jan. 15, 1920, for the purpose of financing the exportation of locomotives, has been repaid in full eight and one-half months in advance of the date of maturity.

The corporation also announced that the advance of $4,000,000 to the International Harvester Co., Chicago, Ill., made in the spring of 1920 for the purpose of financing the exportation of agricultural machinery and implements, has likewise been repaid in full about one year in advance of the maturity dates.

Shipping Board's Plan

In a report to Congress analyzing the proposed plan of government aid to shipping, the Shipping Board states that considerations of marine design and construction justify the differential plan of government aid based on speed, tonnage and distance covered in the foreign trade, ranging from 2 cents per gross ton on ships making 13 knots an hour, to 2.1 cents per gross ton on those making 23 knots and over. The board points out that increased speed above 16 knots per hour involves a greater expenditure for high power machinery and greater cost of fuel consumed.

Farm Machinery Totaled Half Billion in 1920

Farm machinery to the value of $536,945,000 were manufactured in the United States during the year 1920, and all but $66,626,000 worth were sold at home, according to a circular just issued by the United States Department of Agriculture.

The extensive use in agriculture of farm machinery is clearly reflected in the circular. which contains definite information concerning the number and value of tractors, farm implements, vehicles, and other items of equipment; the extent to which farmers purchased different sizes and types, and the kinds and numbers exported. Data collected from 583 manufacturers were used in making up the tables. Figures are given for gas tractors, steam traction engines, plows and listers, and tillage implements, as well as planting, cultivating, haying, and harvesting machinery, machines for preparing crops for market use, and horse-drawn vehicles.

The circular also contains data on the various kinds of machines in the different classifications, from woodsaws to sirup evaporators. Although a few firms refused to give data on their business, enough was secured to make the figures dependable and fairly representative of the industry.

Spring Inspection Meeting of Connecticut Sections of A.S.M.E. and A.S.S.T.

About 250 people, members and friends of the Connecticut sections of the American Society for Steel Treating and the American Society of Mechanical Engineers were the guests of the New Departure Manufacturing Co., Bristol, Conn., on Saturday April 29. The group is shown in the picture below.

Assembling at nine o'clock, the party was divided into groups of fifteen, each group under the guidance of a member of the company's engineering or production staffs. The morning was devoted to an inspection of the plant, which was in full operation. Starting at the receiving sheds where the raw material is delivered directly from the railroad sidings, the parties were conducted through the extensive forge shops, the annealing and carburizing departments, and were given a glimpse of the chemical and physical test laboratories by means of which a close watch is maintained upon the quality of material entering into the New Departure product, which consists mainly of ball bearings.

Considerable time was spent in the heat-treating department, in which the members of the party were particularly interested, as it represents one of the most complete and up-to-date installations in existence for the automatic control of temperatures and heat periods.

A visit to the company's extensive ball plant followed, and from thence the party traced the evolution of a ball-bearing through grinding, assembling, inspecting and testing processes to the display rooms where every kind of bearing made by the company was on exhibition.

At noon a lunch was served in the cafe of the Endee Inn, and after an hour for rest and recreation the party was conducted through the administration building where the executive machinery of the company was explained to the visitors.

In the afternoon a mass meeting was held in the rooms of the Endee Club where F. P. Gilligan, national president of the A. S. S. T., presided. President DeWitt Page, in the name of the New Departure Co., bade the guests welcome, after which W. H. Eiseman, secretary of the A. S. S. T., delivered an address on the general subject of heat-treating, followed by an interesting talk on the "Fatigue of Metals," by Prof. H. F. Moore of the University of Illinois.

During the lunch hour the party was photographed on the lawn in front of the administration building.

SPRING INSPECTION MEETING OF THE AMERICAN SOCIETY FOR STEEL TREATING AND THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS, CONNECTICUT SECTIONS, AT THE PLANT OF THE NEW DEPARTURE MANUFACTURING CO., BRISTOL, CONN.

Engineering Council Flays Patent Legislation

Pending patent legislation was denounced as "dangerous and destructive of the American patent system," before the Senate Patents Committee in Washington on May 1, by a delegation from American Engineering Council of the Federated American Engineering Societies. Edwin J. Prindle, of New York, chairman of the council's patents committee, voiced the protest of the engineers against the passage of the Stanley and Ladd bills, saying that the poor inventor would be injured and that the American patent system would degenerate into a position of the second or third class.

The bills attacked were the Stanley Bill, S-3325, providing for the granting of compulsory licenses where patents have not been worked to a reasonable extent within a reasonable time (which amended Section 4887 of the Revised Statutes of the United States); which bill was replaced by Stanley Bill, S-3410, which applied the same amendment to Section 4886 of the Revised Statutes.

The former Stanley Bill might, in effect, apply only to foreign-owned American patents, but the substitute bill would unquestionably apply to all United States patents, whether owned by American citizens or aliens. The questions of whether a patent had been worked to a reasonable time, are to be decided by the Commissioner of Patents or such other governmental agency as the President shall designate. The Ladd Bill, S-3297, was also introduced, and this bill provides that patents shall lapse if not worked within five years after they are granted, or two years after they have been assigned.

These bills would so lessen the value of patents that the incentive to produce inventions would be so greatly decreased as to put our American patent system in the position of a second or third class system and deprive our country of that incentive to invent which has made us the foremost country in inventiveness, in manufacturing, and in agriculture.

The object of the bills is to throw German-owned American patents open to American use and prevent the Germans from manufacturing in Germany and importing here, while restraining the use of their inventions here through their American patents.

Government Economy in Use of Machinery

Economies in government departments covering machinery during the year which will end June 30 have been reported to Congress by the Budget Bureau. There have been savings of $165,000 at the Frankford arsenal; $193,000 at Rock Island; $40,000 at the Aberdeen Proving Ground; and $92,000 at the Picatinny Arsenal. The Navy Bureau of Engineering reports a saving of $30,000 in the construction of a machinery plant at the Cavite, P. I., naval station, and a $9,000 saving in a plant at Olongapo, P. I. The Bureau of Standards reports savings in its invesigations on testing machines, mechanical apparatus and standardization.

The Navy Bureau of Engineering reports a saving of $90,000 in the fitting out of vessels, recently acquired from the Shipping Board, with pumps, evaporators, generators and refrigerating machinery, by employing used material.

The report was received with favorable comment in Congress.

The Business Barometer

This Week's Outlook in Commerce, Finance, Agriculture and Industry Based on Current Developments

BY THEODORE H. PRICE
Editor, *Commerce and Finance*, New York

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The spotlight of optimism was shifted from the Stock Exchange to the commodity markets last week. Grain, cotton, coffee, steel, copper, lumber, wool, silk, rubber, hides, and even burlaps with its humble parent, jute, are all in some degree higher.

Sugar is about the only important staple that showed a lagging tendency. This was due to the difficulties of a Cuban banking house whose failure was narrowly averted, but the fact that the much talked of Cuban surplus has been so rapidly distributed that stocks on the island are now down to last year's level suggests a situation to which the trade cannot long be oblivious.

Dealers in the other articles named explain the advance in each by reference to some technical influence, but to the student of underlying conditions an improvement which is so all inclusive has a significance that overshadows the details which would have been ignored if the public were not in a mood to interpret them bullishly.

Commodities Higher

Thus wheat is higher because it has suddenly been discovered that the season is late and the indicated demand for export large—but this is hardly news. Corn is slightly higher "in sympathy" with wheat, but sympathy is not a concrete thing—it is an emotion. In the South the temperatures have been low, the Mississippi has carried away some levees and the Government has published a statement which indicates that the consumption of cotton is or soon will be as large as it was before the war.

To these facts the sharp advance in cotton is attributed, but they have been known and pointed out for some time.

The advance in steel, copper and building materials is related to the increase in new construction but it has been stressed in these letters for weeks.

Silk is up from 30 to 50 cents a pound and some in the trade say that the advance is due to Japanese speculation, but the truth seems to be that American distributors have sensed a better demand for silk fabrics. Rubber is not much higher, but it is steadier on the increased demand for tires which has been for some time predicted.

Wool is worth more in America and the wool merchants say that the foreign markets are advancing, but the fact is that the improvement is a reflection of the world's increased purchasing power.

Coffee has recovered the decline recorded last week because the short time coffee loans to the Brazilian government have been refunded in a 30-year bond issue for £9,000,000, which is being offered simultaneously in New York and London. Inasmuch as it would appear that the 4,535,000 bags of coffee pledged for the security of this loan have all been bought and that no more can be purchased except as present holdings are sold the arrangement would not seem to be one that will further advance the market. But the public has preferred to regard it otherwise and those who could not be induced to buy coffee at six cents a pound are now taking it eagerly at ten cents.

The advance in burlaps and jute is attributed to a shortage in the supply that was known but unappreciated until a general improvement in trade which led to a demand for more bags and bagging brought it into relief.

But the improvement in the markets for raw materials has not yet reached the jobbing or the retail trade. It is still confined to the basic staples out of which the things that are sold over the counter are made.

There is and always will be a noticeable interval between activity in the raw materials and an increased distribution of the things into which they are converted by the processes of industry. This interval represents the time required for manufacture. Averaging it at two months the indicated revival in distributive trade is due about July 1 to 15 and it may be expected around that time unless there is widespread crop failure or some other great disaster.

There are many premonitory signs which justify a prediction so precise. In the drygoods market, particularly, many contracts for the future delivery of both cotton and woolen material are being made. Business is decidedly more active, but immediate delivery cannot be had because stocks are light.

Railroad earnings for March were at the rate of 6 per cent annually on the accepted valuation of the properties and the credit of the roads is so much improved that they are able to buy more equipment and make necessary improvements.

A better demand for mercantile credit, and bank clearings, which are now running more than 20 per cent over last year, are other evidences of increased activity. They lead me to again advise prospective borrowers to make their credit arrangements now. The weekly statement of the Federal Reserve System shows a decline of nearly 2 per cent in the reserve ratio which has fallen from 78.3 to 76.7 per cent.

Credit Expanding

For the first time in many weeks the gold held has not increased and the New York bank has in fact lost $24,000,000 of its gold which has been transferred to the other banks. This connotes an expansion of credit and circulation in the interior, and the strength of all foreign exchange except marks suggests that it is quite possible that we may soon have to export some gold against the European bond issues recently placed here and the expenditures of the many tourists who have gone or are going abroad this summer. In that event an immediate tightening of the money market may be anticipated, for our bankers have always been hypersensitive to a loss of gold.

There has been a slight lull in the security markets. Bonds are quieter and some stocks have shown a reactionary tendency but the oil shares are higher on the expectation of an advance in petroleum and the rails are daily becoming more responsive to rumors of consolidations that appeal to the public imagination with increasing force. From Chicago, for instance, it is reported that the Frisco system is negotiating for the purchase of the International & Great Northern, now in the hands of a receiver. I do not know that the report has any foundation in fact, but such a deal if carried out would bring another major railway system into being and the mere suggestion of it inflames speculation.

Then there are the operations of the Van Sweringen brothers of Cleveland. They have already acquired control of the Nickel Plate, the Lake Erie & Western and the Clover Leaf. They are pictured as Harriman's successors with an ambition to create a new trunk line in the central West by consolidation.

The idea may be fanciful but under present conditions it has plausibility and the public who are fond of romance in the railway world are ready to believe it. Their mood has changed and from having been unwilling to believe that prosperity would ever return they are now confident that it is here and will last indefinitely.

Signs Unheeded

The unsettled coal strike is therefore ignored. So is the textile strike. A bonus bill that will ultimately cost over four billion dollars seems to have lost its terror, despite the fact that the public debt increased $45,500,000 in April and the internal revenue decreased $875,000,000 during the nine months ending March 31, chiefly as a result of the falling off in income and excess profits taxes.

The practical failure of the Genoa Conference and a civil war in China are also unheeded, for the delusion that she is independent of the rest of the world is again taking hold of America.

It is the anasthesia of secondary inflation. The anasthetic is the gold we have been importing. We are just beginning to feel its effect. It will last as long as we can borrow easily and cheaply. There is no indication of its immediate ending and before it passes we may witness one of the greatest speculative movements that has ever swept the country.

Those who can go with the tide without surrendering themselves to it and being swept away will indeed be fortunate. The wisest men never try to get the top of the market.

The Trend of Business Improvement—Plants Resuming

The Missouri, Kansas & Texas Railroad Co. has resumed operations at its shops at Sedalia, Mo., following a shutdown since Jan. 19. The plant will be run on a piece-work basis, giving employment to about 500 men.

The Buick Motor Co., Flint, Mich., is increasing its production schedule for the second quarter of the present year, totaling about 40 per cent over the output for the first three months, or approximately 27,000 cars as compared with 19,000 in the January-March period. The company, a division of the General Motors Corporation, will take over the plant of the Scripps-Booth division at Detroit, and will operate an assembly unit at this point.

The Cleveland Tractor Co., Cleveland, Ohio, manufacturer of motor-tractors, has adopted a capacity schedule at its plant, with full working force operating under full time. Around the first of the year the plant was running at less than 40 per cent of normal.

The Packard Motor Car Co., Detroit, Mich., is increasing production 50 per cent in all departments, and will add about 1,000 men to the working force. The plant has been giving employment to about 5,500 operatives, an advance of 1,500 since the first of the year.

Durant Motors, Inc., New York, N. Y., has arranged a production schedule providing for a minimum of 200,000 automobiles during the next year, divided into 120,000 Star cars, and 80,000 Durant machines.

The American Car and Foundry Co. has increased production to a normal basis at its Memphis, Tenn., works, and the regular working force is being employed for the first time in many months. All other plants of the company are now on a capacity basis. A recent order includes 1,700 freight cars for the Chesapeake & Ohio Railroad Co.

The Verona Steel Castings Co., Verona, Pa., has resumed operations at its plant, following a shut down for more than a year. Employment will be given to about 800 men.

Following an increase in the manufacture of Knight motors to a basis of 100 a day, the Wilson Foundry and Machine Co., Pontiac, Mich., is planning to advance the output to 150 motors daily, a maximum production, with extra working shifts.

The American Tube and Stamping Co., Bridgeport, Conn., is arranging for the immediate resumption of operations at its steel plant, which has been closed for about fifteen months past. The company has adopted a capacity schedule at its cold rolling mills.

The Ford Motor Co., Detroit, has scheduled a production of 120,000 cars during May, making the highest output ever attained at the plant. From 5,000 to 8,000 men will be added to the present working force of 37,000 operatives. The former high mark in manufacture was in August, 1921, when the output reached 110,000 cars with the employment of approximately 40,000 men.

The National Acme Co., Cleveland, Ohio, has advanced production at its plant and is now running at better than 90 per cent of capacity. Further increase is expected at an early date. A large part of the output is devoted to radio equipment and parts.

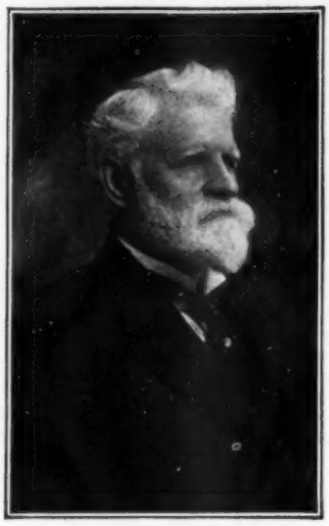
The Iron City Pipe and Foundry Co., Birmingham, Ala., has adopted a capacity schedule at its plant. A large portion of the present output is for shipments to South America and Cuba.

The Chevrolet Motor Co., Flint, Mich., a division of the General Motors Corporation, has inaugurated a night shift at its plant for the first time in a number of months. The plant is operating on a basis of 800 motors and 900 axles per day, with the employment of approximately 3,000 workers.

Ambrose Swasey Elected to Academy of Sciences

Ambrose Swasey, president of the Warner & Swasey Co., Cleveland, Ohio, was elected to membership in the National Academy of Sciences, at the annual meeting held in Washington on April 26.

The National Academy of Sciences is an organization incorporated by an Act of Congress on March 3, 1863, and approved by President Lincoln, to investigate, examine, experiment and report



AMBROSE SWASEY

on any subjects of art or science when called upon to do so by any department of the Government. Members of the Academy are grouped into committees of mathematics, astronomy, physics, engineering, chemistry, and others.

Mr. Swasey is also a member of the National Research Council, which was organized in 1916 at the request of President Wilson, under the charter of the National Academy of Sciences.

This honor was conferred upon Mr. Swasey more especially on account of his achievements in the design and construction of telescopes and other scientific instruments of precision. He established the Engineering Foundation and is an honorary member of a number of leading American and European scientific and engineering organizations, as well as an officer of the Legion of Honor, of France.

Chicago Letter

Business figures for the month of April show a slight increase over those of March and the first week of May has shown a further improvement towards an industrial revival. The increase in the number of inquiries and sales in the last few days, together with the fact that a number of large corporations are advertising extensively for help, shows that confidence has been restored to industry. There is no doubt in the minds of those who have followed past history that the next few years will make up for the years in which production has been at a standstill.

The Chicago, Burlington & Quincy has issued its long expected list which calls for approximately eighty machine tools. The Santa Fe has made a few additional inquiries and is expected to place orders shortly for a number of machines.

During the month of April permits for 1,315 buildings were issued in Chicago, calling for an expenditure of $17,078,560, which is about $2,000,000 lower than last month and a little less than $2,000,000 more than for the same month last year. The gain in number of buildings over last year amounts to 782. There is an evident increase in building activities among residential properties.

The New York Car and Wheel Co. recently purchased a fifteen acre tract adjoining the Standard Steel Car Co. plant at Hammond, Ind., for the reported sum of $18,000. This firm will start construction shortly on a $250,000 building which when completed will employ approximately 250 men. Gostlin, Meyn & Hostings, Inc., handled the deal and report having sold sites to two other big industries, details of which they will give out later.

Among the corporations formed lately are: Advance Radio Co., 169 N. Jefferson St., Chicago, to deal in and manufacture radio outfits and electrical appliances; Theodore Stone, 11 S. LaSalle St. is one of the incorporators. The Airphone Development Co., 111 West Washington St. was recently incorporated with a capital of $20,000 to manufacture and deal in radio equipment. The incorporators are Louis Grossette, W. E. Hooper and W. P. McCracken, Jr.

The Board of Education of Milwaukee, Wis., has issued a list of machinery for which it is in the market. The list is reported to be fairly large.

Longstreth Medals for Inventors

At the April meeting of Franklin Institute, of the State of Pennsylvania, the committee on science and the arts awarded Edward Longstreth medals to four men who have, through their improvements in scientific invention, aided the progress of industry.

The first award was made to Joseph F. Keller, of New York, for his invention of an automatic die cutting machine. Another award was to Samuel T. Freas, of Trenton, N. J., for his interlocking tooth saw. Medals were also presented to Charles F. Wallace and Martin F. Tiernan, of Newark, N. J., for their apparatus for the distribution of liquid chlorine for water purification.

Business Conditions in Germany

By OUR BERLIN CORRESPONDENT

A further drop of the exchange during March has acted as a powerful stimulant to buying, fanning it almost to a feverish heat. The eagerness to transfer paper money into goods on a rapidly rising market almost amounted to a panic. It seemed as though all the repressed and dormant demand was roused into action. The speculative element in this buying craze was very strong. The industries were almost overwhelmed with the rush of incoming orders. Everything within sight was soon sold; delivery times were stretched by months in quick succession, almost within a few weeks. Today it can be said that the larger part of the whole produce of the current year is disposed of. For a considerable number of products, especially those dependent on foreign raw materials, no quotations can be obtained, the long delivery time required putting such commodities entirely out of reckoning.

This applies to all lines of industry hardly without an exception. Even the building trade, which so far has been the Cinderella in German industry, is enjoying a strong revival of business. In the machine building industry, the leading works ask from five to seven months delivery, others three to four months. Such quotations are not always bona fide statements but frequently appear in the light of vague promises strongly guarded by a number of provisos. The chances of getting delivery in schedule time can be judged by the fact that according to reports of the Prussian Chamber of Commerce, many contracts for machinery, concluded last fall on the basis of a delivery of from two to three months, are not yet fulfilled.

Machine Tools Profiting

The present situation of the main branches of the machine building and metal industries can be briefly described as follows: The machine-tool industry is probably profiting most by the existing boom. The demand which at first tended strongly toward quality and specialties, has now extended to quantities, thus benefiting also the second and third ranks of the industry. Standard machinery, which during the first run of the boom last fall was still somewhat neglected, is now also drawn into the vortex of buying. Second-hand dealers have been able to clear a considerable part of their largely accumulated stock and are eagerly buying machinery where it is offered, even of the most obsolete types and in run-down condition. Prices paid for second-hand tools by dealers, which a while ago ranged from 5 to 15 m. per kilogram according to quality and size have now almost doubled. A hustle can be noticed in the market almost bearing a resemblance to war times, and discrimination in buying has been lost. Users are, however, drawing a distinct line against out-of-date designs. It is hard to see where the latter, which are still being made, although in greatly diminished quantities, go to. It can be noticed that the standard of requirements of the average buyer, which in earlier times showed signs of advancing to that set by the leading works, has again somewhat dropped. This is partly due to longer delivery quoted by the manufacturers of the best makes, and also to the fact that the gap in prices between those and the staple tools, which had visibly diminished, has again widened. It must be remembered that the prices for the best quality of tools, which also form the main contingent of the exports, have during the first half of last year been kept in check by the dictates of foreign markets, which pressure was later relieved by the exchange movement, again giving prices a leeway for expansion. Most orders from domestic sources are now placed on a sliding scale, moving in a certain ratio to the increase of cost of material and labor. The manner in which such sliding prices are keyed to increase of cost varies greatly. The best scheme so far, judging from the favor it receives from buyers, seems to be to state the cost of labor and material at the time of the conclusion of the purchase, and to stipulate an increase of the price expressed in per cents for each 5 per cent of increase of wages and material. Foreign buyers rarely accept such an unstable basis for their purchases, and insist upon firm prices, thereby accepting a rather high percentage of risk which the manufacturer is forced to add to his price.

Prices of tools ranged at the beginning of April from 40 m. per kilogram for heavy tools, to 200 m. per kilogram for light precision machinery, like small automatics weighing 250 kg. Besides metal-working machine tools, all labor saving machinery is in great demand.

Power generating machinery is fairly well employed, mostly on orders for renewals. The locomotive industry is enjoying brisk business on light and medium size engines for private domestic orders and for export. The specifications of the state railroads have not yet been placed. Car building works are for that reason in a less fortunate condition. The difficulty is the demand of the railroad administration to contract on firm prices, to which the works find it difficult to accede. Shipyards are employed fairly well on repair work and new ships for the German mercantile marine. Tenders for foreign orders have, however, frequently broken down over the question of price. The automobile industries are exceedingly busy. The leading works are sold out almost to the end of the year.

The electrical industry is doing well in all branches, as great efforts are being made to increase the efficiency of power plants by replacing the existing equipment. The only striking exceptions in the wide field of the metal-working industries are the equipment for electric railways and railroad signal equipment.

Trend of Exports

The exports of machinery have increased since December, although not commensurate with the general rise of business. In February they had not yet reached the total of last July. The following figures show the quantities and value of the machinery exported from July, 1921 to February, 1922. The ad valorem figures are expressed in million paper marks. For the purpose of comparing them with gold mark prices, the average rates of exchange of the various months are shown in the third column.

	Metric Tons	Million Marks	Relation of Marks to the Dollar
1921 July	39,792	790	77
1921 Aug.	29,036	619	84
1921 Sept.	28,757	611	105
1921 Oct.	26,626	647	150
1921 Nov.	27,989	808	263
1921 Dec.	37,484	1,703	192
1922 Jan.	52,695	927	192
1922 Feb.	39,257	1,254	208

As can be seen from the above figures, prices did not keep pace with the exchange movement. In gold marks the value of exported machinery is even decreasing. The gold mark price per ton, which in July was about 1,000 m., has in February dropped to 650 m. This is astonishing in view of the fact that a large part of the sales is effected in foreign currency, a procedure which has been adopted just for the purpose of making exports more or less independent of the fluctuations of the exchange. It is true that February shipments comprise many contracts concluded several months before on the basis of a better exchange, and before the ordinances to quote in foreign money came into force, but the fluctuations of the exchange were, at least in the last five months, not so large that they can satisfactorily explain the drop of the whole value of exports. The system of control of export prices has been greatly perfected, so it is claimed. Judging from the thorough way in which export licences have to pass, it must be assumed that they are handled with circumspection. It is difficult to see how a drop in the value of exports from 44 million gold marks in July to 25½ millions in February, for approximately the same quantity, could pass unnoticed. It would seem, therefore, that either the system of export control or the statistical figures are faulty.

What has been said about machinery in general also applies to machine tools, although in a slightly lesser degree. For the latter, the following returns of the export business from July to February are given.

	Metric Tons	Million Marks
1921 July	8,733	131
1921 Aug.	4,581	88
1921 Sept.	5,544	94
1921 Oct.	4,431	90
1921 Nov.	4,591	104
1921 Dec.	5,389	137
1922 Jan.	6,897	174
1922 Feb.	7,336	178

According to these figures, the average price per ton in July was 15,000 m. or approximately 830 gold marks, while in February it was 24,300 m. or slightly more than 500 gold marks. The latter price constitutes only half of the prewar standard, which was 1,000 m. per ton.

Compared with exports, the machinery imports are insignificant, especially when considering that the supplies from territories detached from Germany under the peace treaty are largely figuring in the imports. The latter are ranging from 200 to 1,000 tons per month. In the list of imported machinery, machine tools occupy the foremost position, machines for agriculture and for the textile industry following. Of the 198 tons of machine

tools imported during the first two months of the year, 81 tons came from America, 37 tons from Austria, and 25 tons from Holland. The latter are probably of American or English origin. The value of these imports is given as 9,300,000 m., or 47,000 m. per ton.

The business of the last few months has sufficed for the industry to recover from the whole previous period of depression, and beyond that to make great strides toward prosperity; so at least it appears on the surface. The inside situation presents, however, less healthy features, causing considerable anxiety.

Since January the living costs have risen by almost 40 per cent. The costs of material upon which the machine building industry depends, have increased almost in the same proportion. Mild steel bars, for instance, which a year ago were 2,440 m. per ton, which price decreased until June to 1,755 m., are now being sold at approximately 10,000 m. per ton. Even this price can hardly be maintained for any considerable time, as the prices of raw material are still moving up in a steep line, and are now approximately where semi-finished products were at the end of February. The dependence of the iron and steel industry on foreign ore supplies is making itself strongly felt. Scrap, which has been a balancing factor, is getting very scarce under the strain of industrial activity. The supply of iron ore has been somewhat eased by large contracts which have been placed on favorable terms for Canadian Wabana ore, and in a limited degree for Spanish ore. The effects of the recent large increase of the coal price are not yet reflected in iron and steel prices, the present level of which is based upon the price conditions of several months ago. It is instructive to compare such prices with those of finished machinery which were in force during the first half of last year. A lathe could then be had at approximately the same price per kilogram as raw castings cost now.

Summing up the situation, it is easy to see that the present industrial activity is taxing the country's financial strength to the utmost limit. Prices have already passed the limit set by the purchasing power of the populace. Every business has, by the buying craze into which the country has dropped so suddenly, been involved in a heavy risk, extending over many months, which can hardly bear any further addition. Manufacturers seem loath to cover themselves with raw material for future contracts. It must be borne in mind that the exchange has reached a dangerous level where a fluctuation of a fraction of a cent reported from New York expresses itself over here in many marks. Signs are visible that the buying wave has passed its crest. Moreover, it is now heard frequently from manufacturers that the industry cannot keep up its present intensity of production, and that the boom having reached a hypertrophical state, a reaction will soon follow. The eyes of the business world are now all turned toward Genoa, and although little is expected to materialize from this conference, it constitutes a strong element of uncertainty for business. The slender chance that something unexpected may happen, which might influence the exchange favorably, is sufficient to put some restraint on all enterprise and cause a temporary lull in business.

Navy to Sell Surplus Iron and Steel

The navy central sales office, Navy Yard, Washington, D. C., will receive bids up to 10 a.m., May 16, for the sale of approximately 350 net tons of iron and steel. The material is located in the Navy Yard at Norfolk, Va., and will be sold in accordance with the terms of sale as stated in catalog No. 83-B. The material is divided into lots and includes wrought iron, strap iron, bar steel, cold-rolled machinery steel in bars, galvanized bar steel, spring bar steel, reinforcing steel, tool steel and steel plate.

Proposals for any of the lots must be made on the authorized form which is attached to the catalog. Bids should be addressed to the officer in charge, Navy Central Sales Office, Navy Yard, Washington, D. C.

More Census Figures

From the recent report of the Bureau of Census we glean some information which should be of interest to manufacturers of machinery.

In 1920 machinists, millwrights and toolmakers numbered 894,662, compared with 488,049 as shown by the 1910 census report. The sub-divisions of the 1920 figure, shown in a special compilation about to be issued by the bureau are: Machinists, 801,901; millwrights, 37,669; toolmakers, die-setters and die-sinkers, 55,092.

The report also shows the total number of mechanical engineers, practicing their profession in 1920, was 37,689. In 1910 the figure was 14,514.

Some Statistics of Manufacturing Industries

In making a special report to the Senate Finance Committee, the Bureau of the Census shows that 521 establishments with an aggregate capital of $366,962,052 are engaged in the manufacture of agricultural implements. Salary and wage payments, when the last census was taken, totaled $88,630,177 annually. These plants have an aggregate horsepower of 128,249. They employ 303 steam engines, 31 steam turbines, 166 internal combustion engines, 72 water-wheels, and 7,993 electric motors.

The 315 automobile plants listed by the census represent $1,310,451,400 of invested capital. The salary and wage payments totaled $379,381,674 in 1919. The aggregate horsepower used was 287,323. These plants employed 170 steam engines, 24 steam turbines, 21 internal combustion engines, and 25,702 electric motors.

Cash registers and calculating machines were manufactured in 65 establishments, representing an invested capital of $82,798,293. The total salary and wage payments was $26,519,935.

Establishments engaged in the manufacture of motorcycles, bicycles and parts are shown by the report to number 51, with an invested capital of $25,362,150. Salary and wage payments total $12,963,593. The aggregate horsepower employed is 14,806.

Eighty-eight establishments with an invested capital of $47,794,300 were engaged in the manufacture of typewriters in 1919. Salary and wage payments totaled $21,079,171. The aggregate horsepower employed was 13,066.

Machinery Exports in March Exceed February

Exports of metal-working machinery increased sharply in March, when the value of foreign shipments reached $1,057,106. This is an increase of $341,861 over the exports of February, but is only one-half the value of similar exports in March, 1921. The increase may be accounted for largely by heavier shipments of lathes and machine tool parts. The detailed figures, which are those of the Bureau of Foreign and Domestic Commerce, are as follows:

EXPORTS

	March 1921	March 1922
Metal working machinery	$2,321,553	$1,057,106
Lathes	337,856	106,561
Boring and drilling machines	.....	51,097
Planers, shapers and slotters	.....	19,885
Binding and power presses	.....	13,511
Gear cutters	.....	1,278
Milling machines	.....	25,817
Sawing machines	.....	3,262
Thread-cutting and screw machines	.....	19,368
Punching and shearing machines	.....	9,191
Power hammers	.....	10,477
Rolling machines	.....	7,067
Wire-drawing machines	.....	968
Polishing and burnishing machines	.....	1,989
Sharpening and grinding machines	95,645	56,584
Chucks, centering, lathe, drill and other	.....	24,414
Reamers, cutters, drills and other parts	.....	151,009
Pneumatic portable tools	.....	23,641
Foundry and molding machinery	.....	97,044
Other metal-working machinery and parts of	1,888,052	433,953
Road-making machinery	107,865	.....
Mining, oil-well and pumping machinery:		
Rock drills	.....	46,121
Mine hoists and derricks	.....	2,826
Ore crushing and screening machinery	.....	73,166
Amalgamation, flotation, etc., machinery	.....	13,239
Smelting and roasting machinery	.....	31,786
Other mining and quarrying machinery	760,452	445,737
Oil-well machinery	1,288,018	.....
Pumps:	1,293,318	551,404
Centrifugal pumps	.....	70,164
Steam	.....	93,849
Other power	.....	163,098
Hand	.....	71,745
Other pumps and machinery	.....	152,548

IMPORTS

Machinery	992,672	979,807

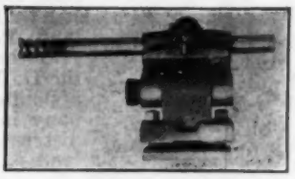
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Toolholder, Boring, Swing

George W. Dover Co., Inc., Providence, R. I.

"American Machinist," January 19, 1922



The holder is held to the lathe toolblock by two bolts and a strap that fits in the T-slot. The bearing about which the swinging member turns is parallel with the bar, and does not affect the parallelism of the cutter bar with the lathe spindle. The bar is secured by means of a yoke drawn up by a hexagon nut. An adjusting screw allows the bar to swing back for inspecting or calibrating the work. A double-lipped bar supplied with the device enables the operator to make two grindings at each trip to the grinding wheel.

Micrometer, Piston-Ring

D. F. Dunham, Oxnard, Cal.

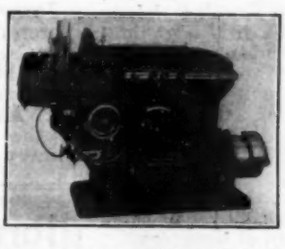
"American Machinist," January 19, 1922

The micrometer is for use in piston ring factories and shops where cylinder regrinding and repairing are done. It is composed of a steel tape secured at one end to a pin and attached to a brass rack at the other end, the rack operating on a pinion. The work is placed within a loop of the steel tape in the opening at the right, and the handle at the left is revolved to tighten the tape on the ring. The size is indicated to 0.001 in. on the dial at the left. Rings from 2⅜ to 5⅛ in. in diameter can be gaged. Since the pressure on the tape closes the ring, its exact size can be determined.

Grinding Machine Ring, Automatic, Rotary-table, No. 25

Heald Machine Co., Worcester, Mass.

"American Machinist," January 26, 1922



The machine grinds such work as the sides of piston rings and ball and roller bearing races. It can be furnished with either an 8, 12 or 16-in. magnetic chuck, but the automatic feeding device is for the 8-in. chuck only. The feeding plate is indexed by a lever and is operated by a friction device. The wheelslide is driven by an hydraulic system to give any feed from nothing up to the maximum. When the machine is used without automatic feed, the chuck bracket can be adjusted to allow for grinding concave and convex surfaces. Wheel: diameter, 14-in.; face, ¾ to 1½ in. Speed, 850 to 1,200 r.p.m. with 10 to 15 hp. Floor space; 90 x 40 in. Weight, 4,000 pounds.

"Detectored"

Bennett Metal Treating Co., Hartford, Conn.

"American Machinist," January 26, 1922

The device determines the atmospheric conditions in steel-treating furnaces, indicating when the furnace is in a reducing, or non-oxydizing condition, and when it is safe to introduce the work without scaling it. Its operation is based on the fact that a hydrocarbon gas is non-inflammable. The steel rod is about ⅛ in. in diameter, and has a hole 0.025 in. in diameter passing lengthwise through it. The handle is in two parts, one being a reservoir filled with kerosene oil and the other a pneumatic pump which creates the air pressure. If the jet of gas ignites, it indicates that too much oxygen is present in the furnace.

Reamer, Hand, Helical-Flute, Expansion

Millersburg Reamer & Tool Co., Millersburg, Pa.

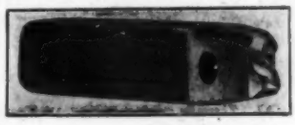
"American Machinist," January 19, 1922

The reamer is furnished in all sizes up to 2⅛ in. in diameter. The helical flutes produce smooth and clean-cut holes of accurate size, due to the shearing action of the blades, and to the elimination of chatter. The blades may be expanded to compensate for wear and resharpening, thus maintaining the original size.

Stamp, Steel, "Super"

Pittsburgh Stencil and Tool Co., 40 Water St., Pittsburgh, Pa.

"American Machinist," January 19, 1922

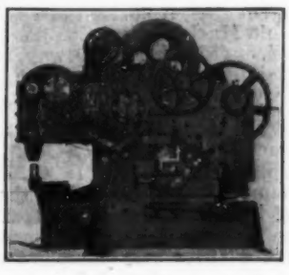


The stamp is used in stamping numerals or symbols in metal. It is made from a special quality of steel and heat-treated. The head is so tempered that it mushrooms and curls down until the pieces merely drop off under the blows, instead of splitting and flying. The end carrying the symbol is hard enough to stamp spring steel.

Punch, Shear and Bar Cutter; Diagonal Stroke; Armor Plate; No. 26

Buffalo Forge Co., Buffalo, N. Y.

"American Machinist," January 26, 1922



The machine can perform three distinct operations at one time without interference. It is not necessary to tilt the work when beveling or mitering. The punch is engaged by a handle or a treadle, the shear by a jaw clutch, and the bar cutter by shifting the ram with a counter-weighted lever. Angles up to 6 in. in size may be placed in the throat for trimming. A 7½-hp. motor operates the machine. Capacity: punching, 1¼ x ¾ in., or 1 x 1 in.; shearing, ¾-in. plates, or 3½ x 1-in. flats, with special upper knife, 8 x ⅞ in., or 2¾ x 1 in. flats; bar cutting, 2¼-in. round, or 2-in. square stock, 8-in. I-beams of 18-lb. weight.

Riveter, Pneumatic, Compression-yoke type

Southwark Foundry and Machine Co., Philadelphia, Pa.

"American Machinist," January 26, 1922

The machine has an operating valve of the plain slide type, with one wick packing on the stem end, and a removable valve seat. The pull-back is accomplished by the line pressure. Two separate pressures on the die are given by a plug cock in the valve plate. The portable machines are provided with suspension bails. When the machines have a reach above 36 in., feet are provided for mounting. Capacities, 10, 17½, 30, 50, 75, 100, 125 and 150 tons. Cylinder diameters, 7½ to 20¾ in. Smallest size: reach, 4 in.; gap, 10 in. Largest size: reach, 21 ft. 6 in.; gap, 24 in.

Business Items

The Norton Company, of Worcester, Mass., has moved its New York office to 53 Park Place.

The name of the Wayne Oil Tank and Pump Co., of Fort Wayne, Ind., has been changed to the Wayne Tank and Pump Co. The organization and product remains the same. The company will market the Barromite water softening systems under the name of Wayne.

The Specialty Gauge and Tool Co., machine tool manufacturers, of Indianapolis, Ind., has filed papers with the secretary of state showing the intention of the corporation to dissolve.

The Minster Machine Co., Minster, Ohio, celebrated the fiftieth birthday of its general manager, A. L. Herkenhoff, with an entertainment and dinner in the plant offices on April 26. The event also celebrated Mr. Herkenhoff's twenty-sixth year as manager of the Minster shops.

The Alaskan Steel Co., Brown & Co., Inc., of Pittsburgh, and Heller Bros. Co., of Newark, N. J., have changed their Chicago office from 28 East Jackson Blvd., to 11 South Desplaines Street.

W. P. Ferguson and A. H. Sunderbruch, 204 Market St., Chattanooga, Tenn., have lately entered into partnership, trading under the name of the Hamilton Machinery Co. The firm will handle a general line of machine tools, boiler shop equipment, electric cranes, hoists, etc. Both members of the firm are old machine tool salesmen and are well known in the South.

Arthur M. Watkins, dealer in machine tools as Eastern agent for the Covington Machine Co., and New York agent for American Tool Works and Ohio Machine Tool Co., has removed his offices from 165 Broadway, to the Dodge Building, 53 Park Place, New York City.

The American Patent Law Association, 614 Washington Loan and Trust Bldg., Washington, D. C., has issued a pamphlet setting forth the testimony of inventors, manufacturers and others on the Stanley compulsory patent bill (S. 3410). The pamphlet will be sent to anyone interested, upon application to the association.

The Campbell-Davenport Co., Inc., has been organized and has opened a garage and machine shop at 55 Smith St., Brooklyn, N. Y.

The machine shop of the Jones & Laughlin Steel Co., in Pittsburgh, Pa., was badly damaged by fire on May 3. The damage is estimated at $60,000.

The Markey Machinery Co., of Seattle, Wash., has converted part of its plant in that city to the manufacture of boilers for heating plants.

The Wilton Tool Co., Sharon, Pa., has started work on a machine shop addition to its plant.

The Sharon Pressed Steel Co., of New York, has removed its offices from 66 Broadway to the warerooms in the Dodge Bldg., at 47 West Broadway.

The Herberts Machinery and Supply Co., of Los Angeles, Cal., has been appointed the exclusive representative in California, Arizona and Nevada for the Norton line of grinding machines.

The Joseph Hollander Manufacturing Co., 172 Wade St., Bridgeport, Conn., manufacturers of hardware and metal specialties, has filed a voluntary petition in bankruptcy. Liabilities are $16,081, and assets $1,650.

J. L. Purcell, Inc., 40 Trumbull St., Hartford, Conn., has been incorporated to carry on a general mill supply business at the above address. The company will take over the present business of J. L. Purcell, which is well known in Connecticut. The new concern will have a capital stock of $100,000. J. L. Purcell, F. J. Murphy and E. M. Day, all of Hartford, are the incorporators.

Banigan Manufacturing Co., of Killingly, Conn., has recently been incorporated to manufacture and deal in tools, machinery, and such products. The capital stock of the company is $50,000, and the incorporators are; J. J. Banigan, Providence, R. I.; Richard D. Banigan, 43 Broad St., Danielson, Conn.; and E. Banigan, also of Danielson.

The West Border Spring Co., of Chelsea, Mass., has been organized with a capital stock of $25,000, to manufacture springs, etc. Herbert T. West, 17 Chestnut St., Winchester, Mass., is president and treasurer of the new concern.

The Budd Wheel Co. has purchased the Government plant at Philadelphia, formerly occupied by the Hero Manufacturing Co. The plant will be arranged to manufacture Budd wire wheels.

The Precision Die Castings Corporation, which has had a plant at Fayetteville, a short distance from Syracuse, N. Y., has been sold by C. Hamilton Sanford, as receiver, to Frank E. Wade for $27,500. The details of re-organization have not been decided upon. Mr. Wade represented the creditors. The reorganized company will operate the Fayetteville plant which normally employs about 200 men. Officers of the new company are: F. E. Wade, president; J. Wiltsie Knapp, vice-president and general manager; H. W. Smith, secretary and treasurer. Frederick P. Assman heads the board of directors.

The McCabe & Sheran Machinery Corporation has moved its sales office from 149 Broadway to 50 Church St., New York City.

Personals

BASIL MILES, who was secretary to the American delegation at the Limitation of Armament Conference, has been appointed administrative commissioner for America at the headquarters of the International Chamber of Commerce in Paris. Mr. Miles succeeds Frederick P. Keppel, who has resigned.

E. M. WAGNER, of the Runecke Wagner Pump and Supply Co., Pittsburgh, has been elected president of the recently organized Manufacturers Club of Pittsburgh, which has purchased the Hotel Chatham, Pittsburgh, for its home.

JOHN N. WEIR, assistant superintendent of the Eliza Furnaces, Jones & Laughlin Steel Co., Pittsburgh, Pa., has resigned to accept a position as superintendent of blast furnaces for the Pittsburgh Crucible Steel Co., Midland, Pa.

HENRY P. RANKIN, at one time connected with the Pittsburgh Crucible Steel Co. as superintendent of construction and later in charge of mill at Midland, Pa., and who for the past few years has been Pittsburgh manager for the H. M. Johns-Manville Co., has been appointed manager for the latter company in the Cleveland and Pittsburgh districts, with headquarters in Cleveland.

J. W. HARTMAN, formerly with the R. K. LeBlond Machine Tool Co., is now South-western manager for the Eccles & Smith Co., with headquarters at Los Angeles, Cal.

R. A. CASE has been appointed general sales manager of the Eccles & Smith Co., with headquarters at San Francisco, Cal.

Obituary

JOHN R. SHERWOOD, sales manager of the Singer Manufacturing Co., manufacturer of sewing machines, Bridgeport, Conn., died at the Bridgeport Hospital on April 26, from the effects of a recent operation. Mr. Sherwood, was well-known in industrial circles in New England and New York.

EDWARD T. BROWN, retired manufacturer of cotton ginning machinery, died at his home in New London, Conn., on May 2. He was eighty-three years old. He was the founder of the Brown Cotton Gin Co., and was its president for many years.

JOSEPH H. BRIGHTMAN, assistant secretary and treasurer of the Brightman Manufacturing Co., South Columbus, Ohio, died at his home in Columbus on April 21. He was thirty-five years old. Mr. Brightman had been engaged in the manufacture of shafting machinery for eleven years.

Forthcoming Meetings

United States Chamber of Commerce: Annual meeting, Washington, D. C., May 16 to 18. Secretary, D. A. Skinner, Riggs Bldg., Washington, D. C.

National Association of Office Managers: Annual meeting, Washington, D. C., May 18 to 20. Secretary, F. L. Rowland.

American Society for Steel Treating: Pittsburgh Section meeting, Bureau of Mines Auditorium, Pittsburgh, Pa., May 25 and 26.

American Foundrymen's Association: Annual meeting, Rochester, N. Y., week of June 5. Secretary, C. E. Hoyt, 140 South Dearborn St., Chicago, Ill.

American Railway Association: Section III, Mechanical: Annual meeting, Atlantic City, June 14 to 21. (Formerly the Master Car Builders and the Association of Master Mechanics.)

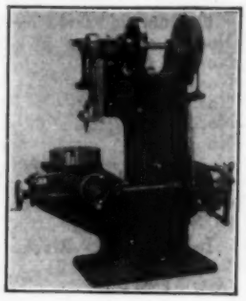
Society of Automotive Engineers: Summer meeting, White Sulphur Springs, W. Va., June 20 to 24. C. F. Scott, 29 West 39th St., New York City, is chairman of the convention committee.

American Society for Testing Materials: Twenty-fifth annual meeting, Chalfonte-Haddon Hall Hotel, Atlantic City, June 26 to July 1. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

Condensed-Clipping Index of Equipment

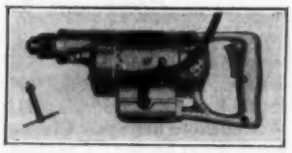
Patented Aug. 20, 1918

Slotting Machine, Die, Vertical
Peters-Bossert Co., 617 East Pearl St., Cincinnati, Ohio.
"American Machinist," January 26, 1922



The machine is used in making dies and punches of either regular or irregular shape, and is fitted with a special mechanism for producing a curved relief on the die. The ram slides in vertical ways, is fitted with a gib, and is driven by a crank on the main shaft, with an adjustable crank-pin to vary the length of stroke from zero up to 4 in. The machine has cross, longitudinal and circular hand feeds, each operated by a separate screw and handwheel. Power feeds may be furnished when desired. A variable-speed gear box inside the frame gives three changes of speed operated by a lever.

Drill, Electric, Portable, Automatic, "Willey"
James Clark, Jr., Electric Co., Louisville, Ky.
"American Machinist," January 26, 1922



The device is used for production work with small sizes of twist drills. It is made in three sizes to hold drills up to $\frac{1}{4}$, $\frac{1}{2}$ and $\frac{5}{8}$ in. The switch for operating the motor is controlled by the grip on the handle. The motor may be wound for either 110 or 220-volt alternating or direct current, single-phase of 60 cycles or less. The tool consists of the spindle with gears, motor body, and handle with the automatic switch. Length, with a Jacobs chuck, 11¾, 12¼ and 13¼ in. respectively. Weight, 6½, 7 and 7¾ pounds.

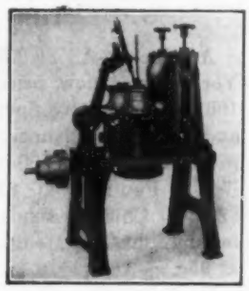
Grinding Machine, Surface, Tilting-Table, Hand-feed, No. 1
Wilmarth & Morman Co., Grand Rapids, Mich.
"American Machinist," January 26, 1922

The machine is adapted to grinding small work on a magnetic chuck in finishing surfaces at angles. The chuck is bolted to the table, which is then tilted to the required angle. The table is provided with T-slots for holding a magnetic chuck, vise or other fixtures, and is graduated in degrees. The truing device on the wheel hood dresses the grinding wheel horizontally or at any angle. A radial truing device which operates from the table can also be furnished.

Chuck, Drill, Small, No. 0
Jacobs Manufacturing Co., Hartford, Conn.
"American Machinist," January 26, 1922

The chuck holds small drills used by jewelers for the drilling of small holes. It is 1¼ in. long and measures ⅞ in. in diameter. It can be furnished with a sleeve of even smaller diameter, so that the chucks may be run in multiple at ¾-in. centers. In this case the sleeve is not knurled. Maximum capacity, ⅛ in. Weight, 2 ounces.

Welding Machine, Tube, Oxy-acetylene
Davis-Bournonville Co., Jersey City, N. J.
"American Machinist," January 26, 1922

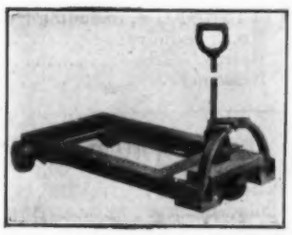


The machine is used in tube making for long runs on one size of tubing. It is equipped with two pairs of rolls, one set for feeding, and the other for welding. The welding roll at the back is fixed in place. The front one is adjustable, and its spindle bearing is in a slide controlled by a screw and handwheel. The upper and the lower feed rolls are geared together. A multiple-jet, water-cooled torch is employed. Maximum capacity is for tubing 6 in. in diameter and of No. 10 gage. Welding can be done on more than one size of tubing with any one machine.

Tapping Machine, Dial-Feed, Multiple-Spindle
Anderson Die Machine Co., Bridgeport, Conn.
"American Machinist," January 26, 1922

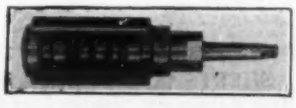
The machine is equipped with three spindles, and is used in tapping small brass and steel pieces. The chief feature of the machine is a dial for feeding the work to the spindles. The spindles are driven in opposite directions by a toothed segment and train of gears. The segment is controlled by a crank disk at the upper end of the vertical shaft, to which are secured the cams for indexing the dial and for locking it in its proper position. The machine when holding from No. 4 to No. 10 taps is ordinarily run at a speed of 56 strokes per minute. Either one, two or three holes can be tapped in each piece.

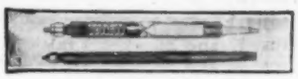
Truck, Lift, Hand-operated
Western Tool and Manufacturing Co., Springfield, Ohio.
"American Machinist," January 26, 1922



The truck is made of iron and steel, and can be turned in its own length, the front wheels swiveling about a ball thrust bearing. Roller bearings are employed on all wheels. With the truck one man can raise a load of 2,000 lb. The lift of the platform is 1¼ in. The platform is ordinarily 23 x 38 in. in size, and 7½ in. above the floor when raised.

Lapping Tools, Internal and External, Replaceable Shell
R. & C. Lap Co., Davenport, Iowa.
"American Machinist," January 26, 1922





The laps are used in tool making and production work in the shop. The abrasive shells are supplied in two grades. The laps are made for both external and internal use in sizes from ¼ in. up. In Fig. 1 is shown the cylinder lapping tool, consisting of a floating shank and an expanding device for adjusting the size, as well as for taking up the wear. In Fig. 2 is shown an external lap for use on crankshafts. A small internal lap is shown in both the sectional and the full view in Fig. 3. The lap is made with a standard shank, and may be fitted in a lathe or drill press, or operated by hand.

Clip, paste on 3 x 5-in. cards and file as desired

The Weekly Price Guide

THIS WEEK'S MARKET

Advances—A leading dealer in shop supplies at New York, issues new price card quoting rivets 20c. higher on 100 lb. lots; active Spring demand also caused nuts, washers and screws to advance. Pig iron quotations in all cities are given at from $1.50 to $3.50 higher, Pittsburgh quoting No. 2 Foundry at $21.30; Basic, $23.00, and Bessemer, $23.96. Chicago sends new prices of iron machinery castings: Light, 5c.; Medium, 4.5c., and Heavy, 3.5c. Linseed oil at 95c.

Declines—Open hearth spring steel (base) New York, at 3.50c.; coppered bessemer rods fell 50c. from 7c. Tin, 5-ton lots at New York, at $31.50. Zinc is firm.

IRON AND STEEL

PIG IRON — Per gross ton — Quotations compiled by The Matthew Addy Co.:

CINCINNATI	
No. 2 Southern	$21.50
Northern Basic	23.52
Southern Ohio No. 2	25.02
NEW YORK—Tidewater Delivery	
Southern No. 2 (Silicon 2.25 to 2.75)	28.56
BIRMINGHAM	
No. 2 Foundry	17.50
PHILADELPHIA	
Eastern Pa., No. 2x, 2.25-2.75 sil.	25.40
Virginia No. 2	28.24
Basic	23.50
Grey Forge	24.46
CHICAGO	
No. 2 Foundry local	22.00
No. 2 Foundry, Southern, sil 2.25@2.75	23.92
PITTSBURGH, including freight charge from Valley	
No. 2 Foundry	21.30
Basic	23.00
Bessemer	23.96

IRON MACHINERY CASTINGS—In cents per pound:

	Light	Medium	Heavy
Pittsburgh	9.0	6.0	3.0
Philadelphia	8.5	5.0	3.0
Atlanta	5.5	4.5	4.0
Detroit	7.0	4.5	3.0
Birmingham	12.0	6.5	3.0
Denver	8.0	6.0	5.0
New Orleans	6.0	4.5	3.5
Minneapolis	9.0	6.0	4.5
New York	9@10	6.0	3.0
Cincinnati	6.0	5.0	4.5
Cleveland	6.75	4.5	2.6
Chicago	5.0	4.5	3.5

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

Blue Annealed	Pittsburgh, Large Mill Lots	New York	Cleveland	Chicago
No. 10	2 40	3.38	3.15	3.38
No. 12	2.45	3.43	3.20	3.43
No. 14	2.50	3.48	3.25	3.48
No. 16	2.70	3.58	3.35	3.58
Black				
Nos. 17 and 21.	3.00	4.05	3.55	4.10
Nos. 22 and 24.	3.05	4.10	3.60	4.15
Nos. 25 and 26.	3.10	4.15	3.65	4.20
No. 28	3.15	4.25	3.90	4.30
Galvanized steel sheets:				
Nos. 10 and 11.	3.15	4.25	3.75	4.30
Nos. 12 and 14.	3.25	4.35	3.85	4.40
Nos. 17 and 21.	3.55	4.65	4.15	4.70
Nos. 22 and 24.	3.70	4.80	4.45	4.85
No. 26	3.85	4.95	4.60	5.00
No. 28	4.15	5.25	4.90	5.30

WROUGHT PIPE—The following discounts are to jobbers for carload lots on the latest Pittsburgh basing card:

Steel Inches	Black	Galv.	BUTT WELD Inches	Iron Black	Galv.
1 to 3	71	58½	⅜ to 1¼	44½	29½
LAP WELD					
2	64	51½	2	39½	25½
2½ to 6	68	55½	2½ to 4	42½	29½
7 to 8	65	51½	4½ to 6	42½	29½
9 to 12	64	50½	7 to 12	40½	27½
BUTT WELD, EXTRA STRONG, PLAIN ENDS					
1 to 1½	69	57½	⅜ to 1¼	44½	30½
2 to 3	70	58½			
LAP WELD, EXTRA STRONG, PLAIN ENDS					
2	62	50½	2	40½	27½
2½ to 4	66	54½	2½ to 4	43½	31½
4½ to 6	65	53½	4½ to 6	42½	30½
7 to 8	61	47½	7 to 8	35½	23½
9 to 12	55	41½	9 to 12	30½	18½

Malleable fittings. Classes B and C, Banded, from New York stock sell at net list. Cast iron, standard sizes, 20–5% off.

WROUGHT PIPE—Warehouse discounts as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	66%	53%	60½%	47½%	62½%	48½%
2½ to 6 in. steel lap welded	61%	47%	58½%	44½%	59½%	45½%

Malleable fittings. Classes B and C, Banded, from New York stock sell at list less 10%. Cast iron, standard sizes, 32–5% off.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	3.50	6.00	4.50
Spring steel (light) (base)	6.00	6.00	6.00
Coppered Bessemer rods (base)	6.50	8.00	6.03
Hoop steel	3.38	2.81	3.13
Cold rolled strip steel	6.25	8.25	6.35
Floor plates	4.70	4.66	4.98
Cold finished shafting or screw	3.35	3.00	3.30
Cold finished flats, squares	3.85	3.50	3.80
Structural shapes (base)	2.58	2.41	2.38
Soft steel bars (base)	2.48	2.31	2.28
Soft steel bar shapes (base)	2.48	2.31	2.28
Soft steel bands (base)	2.98	....	2.88
Tank plates (base)	2.58	2.41	2.38
Bar iron (2.00@2.10 at mill)	2.48	2.21	2.28
Drill rod (from list)	55@60%	55%	50%
Electric welding wire:			
⅝	8.00		12@13
⅜	6.50		11@12
½ to ¼	6.25		10@11

METALS

Current Prices in Cents Per Pound

	New York	Cleveland	Chicago
Copper, electrolytic (up to carlots), New York			13.62½
Tin, 5-ton lots, New York			31.50
Lead (up to carlots), St. Louis, 5.40; New York			5.75
Zinc (up to carlots), St. Louis, 5.27½; New York			5.62½
Aluminum, 98 to 99% ingots, 1-15 ton lots	19.20	20.00	18.00
Antimony (Chinese), ton spot	5.50	6.75	6.25
Copper sheets, base	19.50@20.50	19.50	23.00
Copper wire (carlots)	14@14.25	16.00	16.25
Copper rods (ton lots)	17.75	21.00	19.50
Copper tubing (100-lb. lots)	20.75	22.50	23.00
Brass sheets (100-lb. lots)	15.75	17.00	18.75
Brass tubing (100-lb. lots)	18.00	18.50	20.50

—Shop Materials and Supplies

METALS—Continued

Brass rods (1,000-lb. lots)	13.75	15.00	15.75
Brass wire (carlots)	16.25	17.75	.....
Zinc sheets (casks)	8.50	17.25	15.75
Nickel (ingot and shot), Bayonne, N. J.	36.00	.....	.....
Nickel (electrolytic), Bayonne, N. J.	39.00	.....	.....
Solder (½ and ½), (caselots)	23.00	22.00	19.00
Babbitt metal (fair grade)	30.80	39.50	36.00
Babbitt metal (commercial)	15.50	13.50	9.00

SPECIAL NICKEL AND ALLOYS—Price in cents per lb.

Malleable nickel ingots	45
Malleable nickel sheet bars	47
Hot rolled rods, Grades "A" and "C" (base)	50
Cold drawn rods, Grades "A" and "C" (base)	60
Copper nickel ingots	37
Hot rolled copper nickel rods (base)	45
Manganese nickel hot rolled (base) rods "D"—low manganese	54
Manganese nickel hot rolled (base) rods "D"—high manganese	57

Base price of monel metal in cents per lb., f.o.b. Bayonne, N. J.:

Shot	32.00	Hot rolled machined rods (base)	48.00
Blocks	32.00	Hot rolled rods (base)	40.00
Ingots	38.00	Cold drawn rods (base)	50.00
Sheet bars	40.00	Hot rolled sheets (base)	45.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Copper, heavy, and crucible	10.00	11.75	10.25
Copper, heavy, and wire	9.50	10.75	9.25
Copper, light, and bottoms	8.50	9.00	8.25
Lead, heavy	3.75	4.50	3.65
Lead, tea	2.75	3.25	3.00
Brass, heavy	5.75	6.00	8.00
Brass, light	4.25	4.50	4.75
No. 1 yellow brass turnings	5.00	5.50	5.00
Zinc	2.75	2.50	2.50

TIN PLATES—American Charcoal Plates—Bright—Cents per lb.

		New York	Cleveland	Chicago
"AAA" Charcoal Melyn Grade:				
IC,	20x28, 112 sheets	20.00	18.25	18.50
IX,	20x28, 112 sheets	23.00	21.00	20.90
"A" Charcoal Allaways Grade:				
IC,	20x28, 112 sheets	17.00	16.00	17.00
IX,	20x28, 112 sheets	20.00	18.75	19.60
Coke Plates, Bright				
Prime, 20x28 in.:				
100-lb.,	112 sheets	12.50	11.00	14.50
IC,	112 sheets	12.80	11.40	14.80
Terne Plate				
Small lots, 8-lb. Coating:				
100-lb.,	14x20	7.00	5.60	7.25
IC,	14x20	7.25	5.85	7.40

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb	$0.07½@$0.10	$0.12	$0.12
Cotton waste, mixed, per lb	.055@.09	.09	.09
Wiping cloths per M., 13½x13½	.....	50.00	55.00
Wiping cloths per M., 13½x20½	.....	55.00	65.00
Sal soda, 100 lb. lots	2.80	2.50	2.65
Roll sulphur, 360 lb. bbl., per 100 lb	2.85	3.25	3.50
Linseed oil, per gal., 5 bbl. lots	.95	.95	.99
White lead, dry or in oil	100 lb. kegs.	New York, 12.25	
Red lead, dry	100 lb. kegs.	New York, 12.25	
Red lead, in oil	100 lb. kegs.	New York, 13.75	
Fire clay, per 75 lb. bag		.80	1.00
Coke, prompt furnace, Connellsville	per net ton	$3.25@$3.50	
Coke, prompt foundry, Connellsville	per net ton	$4.25@$4.75	

SHOP SUPPLIES

Current Discounts from Standard Lists

	New York	Cleveland	Chicago
Machine Bolts:			
All sizes up to 1x30 in	55%	60–10%	60%
1½ and 1¼x3 in. up to 12 in	40%	60-10-10%	60-10%
With cold punched sq. nuts	40%	.....	....
With hot pressed hex. nuts up to 1x30 in. (plus std. extra of 10%)	45%	.....	$4.00 off
Button head bolts, with hex. nuts	30%	$3.90 net	.....
Hex. head and hex. nut bolts	35%	.....	65-5%
Lag screws, coach screws	55%	.....	60-5%
Square and hex. head cap screws	75—10%	75%	70-10%
Carriage bolts, up to 1 in. x 30 in.	45%	60-10%	50-5%
Bolt ends, with hot pressed nuts	55%	.....	55%
Tap bolts, hex. heads	+10–15%	.....	.....
Semi-finished nuts ⅝ and larger	70%	75–10%	80%
Case-hardened nuts	65%	.....	.....
Washers, cast iron, ½ in., per 100 lb. (net)	$4.50	$3.50	$3.50
Washers, cast iron, ⅝ in. per 100 lb. (net)	3.75	3.50	3.50
Washers, round plate, per 100 lb. Off list	4.00	....	3.50 net
Nuts, hot pressed, sq., per 100 lb. Off list	2.50	3.50	4.00
Nuts, hot pressed, hex., per 100 lb. Off list	2.50	3.50	4.00
Nuts, cold punched, sq., per 100 lb. Off list	2.50	3.50	4.00
Nuts, cold punched, hex., per 100 lb. Off list	2.50	3.50	4.00
Rivets:			
Rivets, $\frac{7}{16}$ in. dia. and smaller	60-5%	60-10-10%	60-10%
Rivets, tinned	60-5%	60-10-10%	4½c. net
Button heads ¾-in., ⅞-in., 1x2 in. to 5 in., per 100 lb (net)	$3.70	$3.25	$3.00
Cone heads, ditto (net)	3.80	3.35	3.10
1½ to 1¾-in. long, all diameters, *EXTRA* per 100 lb	0.25	.....	0.15
⅝ in. diameter *EXTRA*	0.15	.....	0.15
½ in. diameter *EXTRA*	0.50	.....	0.50
1 in. long, and shorter *EXTRA*	0.50	.....	0.50
Longer than 5 in. *EXTRA*	0.25	.....	0.25
Less than 200 lb. *EXTRA*	0.50	.....	0.50
Countersunk heads *EXTRA*	0.35	.....	$3.35 base
Copper rivets	60–5%	50%	50-10%
Copper burs	40%	50%	.....
Lard cutting oil (50 gal. bbl.) per gal.	$0.65	$0.50	$0.67½
Machine oil, lubricating, (50 gal. bbl.) per gal.	0.45	0.35	0.40
Belting—Present discounts from list in fair quantities (½ doz. rolls)			
Leather:			
Light grade	50%	50–5%	60–10%
Medium grade	40–5%	40–10–2½%	50%
Heavy grade	35%	40%	40–5%
Rubber and duck:			
First grade	60–5%	50–10%	40-10%
Second grade	60–10–5%	60–5%	60–5%
Abrasive materials—In sheets 9x11 in.:			
No. 1 grade, per ream of 480 sheets, Flint paper	$5.84	$3.85	$6.48
Emery paper	8.80	11.00	8.80
Emery cloth	27.84	32.75	29.48
Flint cloth, regular weight, width 3½ in., No. 1 grade, per 50 yd. roll,	4.50	.....	4.95
Emery discs, 6 in. dia., No. 1 grade, per 100.			
Paper	1.32	.....	1.49
Cloth	3.02	.....	3.20

New and Enlarged Shops

Machine Tools Wanted

Cal., Oakland—Kingiving Co., 5522 Carlton St.—one automatic or hand operated turret lathe hollow spindle to take 4¼ in.; one automatic or hand operated turret lathe with hollow spindle to take 6¼ in.; metal band saw, Napier preferred; one small plain mill; any quantity of cold drawn steel tubing, 3 in. to 6¼ in. OD., at least ⅞ in. wall thickness, any lengths—butt ends will do.

Conn., Bridgeport—The Amer. Fabrics Co., 1069 Connecticut Ave., W. Lloyd, Purch. Agt.—one No. 1, 10 in. x 24 in. universal grinder; one No. 2, 18 in. x 6 in. x 9¼ in. surface grinder, equal to Brown & Sharpe, (used).

Conn., Springdale — The Segal Metal Products—grinders, stamping machines, etc., for machine shop.

Ill., Chicago—The Amer. Steel Foundries, McCormick Bldg.—one 5 ft. radial drill variable speed motor drive; one 20 in. x 14 ft. and one 24 in. x 14 ft. lathe, both belt driven.

Ill., Chicago—G. Hanson, 2642 North Mogart St.—punch press similar to Bliss No. 19, 20 or 21, and one 16 in. shaper.

Ill., Chicago—K. Wright, 1225 East 44th Pl.—one 200 lb. Bradley helve hammer.

Ill., Kewanee—The Walworth Mfg. Co., P. O. Box 317, R. W. Gamble, Kewanee Wks. Purch. Agt.—one 36 in. simplex radial drill with tapping attachment.
One 24 in. x 60 in. duplex vertical milling machine.
One 48 in. New Era type bullard vertical lathe.
One 16 in. surface grinder with magnetic chuck, 220 volts.
One 3 in. x 10 in. flat turret lathe.
One 28 in. x 11 in. heavy duty turret lathe.
Three 10 in., 12 in., 14 in. or 15 in. x 54 in. turret lathes.
One 20 in. x 8 ft. heavy type turret lathe.

Ill., Rockford—The Barber Colman Co., H. W. Bails, Purch. Agt.—two No. 4 Lees Bradner thread millers, 14 in. between centers, 10 in. swing one Brinnel Hardness testing machine 3,000 kw.; one Ericksen machine for testing sheet; one Universal testing machine, 3 or 4 screw type of 50-100,000 lb. (25-50,000 kg.) capacity with automatic and autographic beam.

Mich., Detroit—The General Steel Mchy. Co., 2530 Taylor Ave., A. L. Tushbant, Purch. Agt.—miscellaneous machine tools for general machine work.

Mich., Detroit—The Monroe Sheet Metal & Welding Co., 850 Porter St.—metal working equipment.

Mo., Joplin—The Dunn Auto Shop, 715 Virginia Ave., J. J. Dunn, Purch. Agt.—power lathe, drill press and emery wheel.

Mo., Joplin—The Jeffries Grading Co., 1514 Main St., B. C. Burges, Purch. Agt.—wood lathe for power machinery.

Mo., Joplin—The Joplin Radio Shop, 422½ Main St., J. J. Graber, Purch. Agt.—electric power punch for copper, brass and soft metal work.

Mo., Joplin—G. Kost, 802 Main St.—lathe for motorcycle repair work.

Mo., Joplin—Loomis & Banon, 210 West 15th St., C. Loomis, Purch. Agt.—lathe for garage.

Mo., Joplin—W. Zook, 1601 Grand Ave.—drill press, lathe and emery wheel for automobile repair work.

Mo., St. Louis—The Brown Mchy. Co., 2323 North 9th St., A. Brown, Purch. Agt.—band saws, 20, 26 and 36 in.; coping lathes; rip saws and matcher; 30 x 6 in. double surfacer; borers; trimmer; edgers; saw mills; log saws, wood saws for power machinery.

Neb., College View—The Service Garage, C. Gipson, Purch. Agt.—Weaver press and one 3-wheel Weaver jack, (used).

N. H., Keene—The Humphrey Machine Co., manufacturer miscellaneous machinery—one milling machine similar to No. 4 Cincinnati; one Wolcott screw cutting engine lathe 16 in. x 8 ft.; one 16 in. Wolcott crank shaper.

N. Y., Binghamton—R. J. Bump Co., Wall St.—bench miller and vertical post drill.

N. Y., Buffalo—McKaig-Hatch Inc., 1584 Niagara St.—machines and equipment for proposed machine shop on Skillen and Ontario Sts.

N. Y., Geneva—W. L. Parkard—modern screw cutting lathe, 32 in. swing, 8 ft. between centers.

N. Y., New York—The Electric Motor & Mchy. Co., 250 East 43rd St.—3 electric motors, 4 drill presses and several lathes.

N. Y., New York—The Elk Manufacturing Co., 1926 Bway., experimental work—magnetic chuck, demagnetizer and internal grinding attachment for No. 13 Brown and Sharpe Universal grinder.

N. Y., Rochester—W. P. Farley, 1005 Harvard St.—machinery and equipment for proposed machine factory.

N. Y., Watertown—G. Bushnell, 621 Lansing St.—lathe, 14 in.-18 in. back geared; drill press; bench miller and portable electric drill; small tool equipment for shop for motor repairs and small machine work.

O., Cleveland—The A. & B. Box Co., 8628 Woodland Ave., H. C. Roberts, Secy.—band saws, lathes and box nailers.

O., Columbus—The Columbus Heating & Ventilating Co., 1125 West Town St., C. A. DaMonte, Secy.—several pieces of metal working machines.

O., Columbus—The Miller-Van Horn Co., 81 East Main St., J. Van Horn, Purch. Agt.—one drill press and one grinder.

Pa., Beaver Springs—J. A. Catherman, (woodworker)—hollow chisel mortiser.

Pa., Meadville—P. Galbo—machinery and tools for new garage on Pine St.

Pa., Mercer—The Star Fdry. & Machine Co., V. Doak, Purch. Agt.—machinery and equipment for foundry and machine shop.

Pa., Phila.—H. Rosenfeld, 431 Fitzwater St.—several 30 in. square shears, (used).

Pa., Pittsburgh—The Acme Stamping & Mfg. Co., 207 Corliss St.—one 3 A Bliss double crank geared press, (used).

Pa., Sharon—F. Messersmith—machinery and equipment for proposed garage in Brookfield.

Wis., Cable—The Cable Auto Co.—equipment for proposed garage on Main St.

Wis., Kaukauna—W. Van Lieshout—equipment for auto repair work.

Wis., Kennosha—Krisor Bros., 772 Milwaukee Ave.—equipment for auto repair shop including 2 ton press.

Wis., Madison—The Madison Gas & Electric Co., 120 East Main St., J. St. John, Mgr.—auto repair equipment for proposed service station and garage on Main St.

Wis., Madison—Wingra Park Garage Co., 1501 Monroe St.—equipment for repair shop including press, compressor, etc.

Wis., Milwaukee—The South End Garage, Kinnicinnic and Fernwood Aves.—medium size drill press for use in garage.

Wis., Racine—J. C. Olsen, Route 3, Box 71—one sheet metal brake, folder rolls, turner, burning machines, beader and ruler.

Ont., Drumbo—J. Harmer—complete equipment for garage and auto repair shop. Estimated cost, $40,000.

Ont., Welland—L. R. Weeks Eng. Co.—rolling machine for seamless steel tubing plant.

Machinery Wanted

Conn., Stafford—The Phoenix Woolen Co., manufacturer of woolens, jersey cloth, etc.—one cloth drying machine, Heathcote Upright preferred.

Ky., Lexington—The Bybee Pottery Co., c/o T. B. McCoun—machinery and equipment for proposed pottery plant.

Mass., Charles River—C. Hall—five-cut "Link & Link" 26 or 28 in. bed space knitting machine; one 6-spindle sheen winder machine; 500 or 600 seven point single thread loopers, (used).

Mich., Detroit—The Gunberg Packing Co., 2380 20th St.—miscellaneous mechanical equipment for the manufacture of sausages, etc.

Minn., Bemidji—The Bemidji Woolen Mills—one napping machine suitable for napping blankets, (used).

Minn., Fergus Falls—The Fergus Falls Woolen Mills Co.—one cloth drying machine, (used).

Minn., Mankato—The Mankato Co-operative Dairy Assn., A. L. Veigel, Mgr.—ice cream machinery, including 15 ton ice machine and some cream vats.

Mo., Joplin—A. Boswell & Co., 628 Main St., manufacturer of face powder, etc., H. Arthur, Purch. Agt.—powder grinders and mixers.

Mo., Joplin—H. Hakon, Frisco Bldg.—lense grinders for power equipment.

Mo., Joplin—The Jones Optical Co., 509 Main St.—lense grinders and polisher for power equipment.

Mo., Joplin—The Keystone Products Co., 10th and Wall Sts., G. G. Delzell, Mgr. and Purch. Agt.—belting and shafting for soap factory.

Mo., Joplin—The Printers Bulletin, 1621 Main St., J. Anderson, Purch. Agt.—linotype, power metal cutting off machine, stenotype machine and casting box for print shop.

Mo., Joplin—A. Stevens, 709 Virginia Ave.—air compressor, belting and shafting.

Mo., Kansas City—C. Thompson, 98th and Holmes Sts.—belting and shafting for creamery.

Mo., St. Louis—The Acme Electric Co., 221 Market St.—Curtis air compressor, with tank and motor.

Mo., St. Louis—The Natl. Lead Co., 722 Chestnut St., W. M. Lowry, Purch. Agt.—one a.c. electric driven mine hoist, rope capacity of 800 ft. of 1¼ in. rope, single laid on drum, capacity 15,000 lb. unbalanced load rope full 22,000 lb.; two 1,500 cu.ft. free air per min. air compressors, 100 lb. pressure, motor or belt drive, a.c. direct connected, preferred; two 2,000 cu.ft. free air per min. air compressor, 100 lb. pressure, motor or belt drive, 140 lb. steam pressure, 1,250-1,500 k.w. a.c. generator, 3 phase, 60 cycle; one low pressure turbine, 140 lb. steam pressure, 1,250-1,500 k.w. a.c. generator, 3 phase, 60 cycle.

N. J., Belleville—The Thompson Machine Co., 298 Main St., W. J. M. Walker, Treas.-Genl. Mgr.—blue-printing machine and steel filing equipment to file drawings, tracings and sketches.

N. Y., Binghamton—The Nailless Heel Co., Court and Milford Sts., O. Cone, Purch. Agt.—special machinery and equipment for the manufacture of shoe heels.

N. Y., Binghamton—L. & S. Battery Mfg. Co., 659 Washington Ave., C. H. Langdon, Purch. Agt.—machinery and equipment for the manufacture of storage cells, charging apparatus and panels.

N. Y., Buffalo—The Buffalo Nipple & Machine Co., 335 Glenwood Ave.—enameling oven.

N. Y., Carthage—R. D. Reichel—printing presses and other machinery requirements for daily newspaper.

N. Y., Chemung—G. Shaw Co.—saw mill machinery and equipment to replace fire loss.

N. Y., Franklin—F. Hoffman—machinery and equipment for making pastry and bread, including pans, mixing troughs and mixer, electric driven.

N. Y., Jamestown—H. R. Ericson, 14 Spring St., Ext.—small or medium size printing press and small engraving machine or machinery.

N. Y., Jamestown—C. F. Carlson, 19 Norwood Ave., Sta. A.—printing press, (new or used).

N. Y., New York—J. W. Sullivan Co., 827 East 9th St.—steam driven 2 stage air compressors with capacity 1,200 cu.ft. per min.

N. Y., Rome—W. E. Allison Co., Washington and Front Sts.—knitting looms and machinery for the manufacture of underwear, etc.

N. Y., Rome—F. C. Spadaforce, 831 East Dominick St.—complete electric driven air compressor and tank for high pressure.

N. Y., Schenectady—The Mary Ann Creek Mining Co., Inc., 469 State St., W. F. Wellman, Purch. Agt.—fine grinding machines, Ball or equal; cyanide oil flotation equipment; rock drills, air compressor and rock handling equipment.

N. Y., Utica—The Utica Independent Laundry Corp., 21 Grant St., B. Abelove, Purch. Agt.—machinery and equipment for modern laundry.

N. Y., Watertown—A. E. Marshall, I. O. O. F. Bldg., Stone St.—machinery and equipment for repairing and charging storage batteries.

N. Y., Watertown—The Shaughnessy Knitting Co., 208 East Moulton St., M. J. Shaughnessy, Purch. Agt.—machinery and equipment for the manufacture of fibre silk underwear.

N. Y., Watertown—P. S. Slate, Otis Bldg.—shafting and transmission equipment and electric motors for board mill at Black River.

N. Y., West Seneca (Buffalo P. O.)—The Triangle Dairy Co., Inc., W. J. Milligan, 236 Triangle St., Buffalo, Purch. Agt.—machinery and equipment for proposed dairy.

N. C., Canton—W. T. Barker—canning machinery and equipment for proposed factory.

N. C., Kinston—R. W. Fowler Co.—cold storage and ice making machinery and equipment.

N. C., Salisbury—The Rowan Creamery Co., W. G. Yeager, Mgr.—butter, creamery and refrigerating machinery and equipment.

N. C., Wilmington—W. C. Smith, P. O. Box 1128—machinery for knitting mill and machinery for sawmill.

O., Cincinnati—The Maxwell & Rothschild, Textile Bldg.—one doubling and folding machine, Windle make preferred, (used).

O., Cleveland—The Industrial Fibre Corp. of America, West 98th and Walworth Sts., W. W. Birge, Pres.—twisting and reeling machines.

O., Cleveland—The Western Novelty Mfg. Co., 1540 East 49th St.—one 12 x 18 or 14 x 22 press and 30 in. paper cutter.

O., Cleveland—The Wilberite Roofing Co., Brook Park Rd., F. S. Wilber, Sales Mgr.—additional machinery for the manufacture of roofing materials.

O., Columbus—The State of Ohio, Dept. of Welfare, Oak and 9th Sts.—steam driven air compressor for Massillon State Hospital, Massillon, estimated cost, $6,000; ice manufacturing machine, 10 ton capacity, for Ohio Sanitarium, Mt. Vernon, estimated cost, $6,500; coal crusher and conveyor for the Cleveland State Hospital Cleveland, estimated cost, $3,500.

Okla., St. Louis—A. S. Partridge—double engine, single drum hoist.

Pa., Bradford—The Bradford Era—fast printing press and other equipment for proposed printing plant.

Pa., Erie—The Odin Stove Mfg. Co.—equipment for stove factory on West 12th St.

Pa., Phila.—The Phila. Brewing Co., Fairhill and Clearfield Sts.—woodworking machinery, steam bending machine for wood, metal working machine and various machines for brewery.

Pa., Phila.—The Superior Knit Wear Corp., 8th and Wallace Sts.—double rolling napping machine 60 in., (used).

Pa., Phila.—H. Swoboda & Sons, Inc., 1027 North Bodine St.—acid vats, conveyor systems, finishing and polishing machinery for leather factory.

Pa., Pittsburgh—The A. S. Davison Co., Oliver Bldg.—one 10 ton, 50 ft. span overhead traveling crane.

Pa., Warren—F. Nichols, Balzinger Blk.—machinery, tools and equipment for modern shoe repair shop.

S. C., Bennettsville—O. R. Brown—machinery to manufacture boxes, barrels, etc.

S. C., Clinton—The Thornwell Orphanage, L. R. Lynn, Pres.—machinery and equipment for laundry.

S. C., Greenwood—M. C. Marshall—complete machinery and equipment for canning factory.

W. Va., Parkersburg—The Seward Wire Co., T. J. Seward, 17 West 42nd St., New York, Mgr.—insulated wire machinery for manufacturing rubber covered electric wire.

Wis., Appleton—The Weber Knitting Mills, 624 Richmond St.—motors, power machinery, knitting and special machinery for proposed knitting mill on Main St.

Wis., Clinton — Terwilliger — gasoline storage tank and pump for garage.

Wis., Eldorado—Dodd School Cheese Factory, Route 1, F. Dodd, Pickett, Purch. Agt.—belt driven machinery and vats for manufacturing cheese.

Wis., Hartford—J. A. Grimm—conveyor for coal hoppers.

Wis., Hartford—A. P. Janzer, Palace Bakery—mechanical baking equipment, steam tank.

Wis., Lake Geneva—The Mann Candy Co., c/o F. Mann, Pres.—motors, refrigerating machinery and special machinery for proposed ice cream plant.

Wis., Madison—The Bd. Normal School Regents, Capitol Bldg., W. J. Kettle, Secy.—blacksmith machinery and machinery for tool repairing at State Normal School, Platteville.

Wis., Milwaukee—J. C. Heisa, 5010 Vliet St.—air compressor complete with motor and tank.

Wis., Milwaukee—H. Nesser, 1257 26th St.—portable power sawing outfit.

Wis., Morgan (Gresham P. O.)—O. E. Morgan—belt driven planing mill machinery.

Wis., Portage—The Market Grocery—mechanical baking equipment, including oven, portable Vulcan or equal.

Wis., Prairie du Chien—The Prairie du Chien Woolen Mill Co., J. W. Paris, Secy.—about 28 looms for woolen mill.

Wis., Pulaski—The Northern Oak Chair Co., c/o F. Poprocki—special woodworking machinery.

Wis., Rosholt—J. Wiza—gasoline storage tank with pump and air compressor.

Wis., Sturgeon Bay—Peterson Bros. Co., c/o G. Peterson—equipment for auto repair work including compressor, one ton press, etc.

Wis., Trippville (Glendale P. O.)—H. Wheeler—complete equipment for blacksmith shop.

Wis., Truesdale—The Truesdale Canning Co., 78 North Main St., E. Mischler, Pres.—canning machinery and conveyors for proposed cannery.

Wis., Waukesha—O. W. Rowlands, Route 9—special machinery for proposed pasteurizing plant.

Wis., Wisconsin Rapids—Hein & Sutor, 142 1st St.—paper cutting machine.

Ont., Niagara Falls—E. Coste & Co., Ltd., has taken leases on a large area in Tilbury West and plan to drill for natural gas—natural gas drilling equipment. Estimated cost, $35,000.

Ont., St. Jacobs—The Snider Flour Milling Co.—modern flour milling equipment.

Ont., Welland—The Empire Cotton Mills, Ltd.—150 automatic looms for weave shed addition.

Ont., Woodstock—A. Hastings & Son, Dundas and Berch Sts.—seven visible oil and gas pumps operated by electric vacuum system.

Man., Winnipeg—The W. A. T. Electrical Mfg. Co., 402 Lotredale Ave.—automatic machine for wrapping celluloid.

Metal Working Shops

Cal., San Francisco—L. R. Lurie, Flatiron Bldg., has had plans prepared for the construction of a 1 story machine shop on Folsom St. near 5th St. Estimated cost, $15,000. S. Heiman, 57 Post St., Archt.

Conn., Waterbury—The Connecticut Light and Power Co., Lakeville St., has had plans prepared for the construction of a 4 story, 60 x 135 ft. garage, etc., on Freight St. Estimated cost, $100,000. L. A. Walsh, 51 Leavenworth St., Archt.

Ill., Chicago—R. F. France, Archt., 155 North Clark St., is receiving bids for the construction of a 1 story, 100 x 200 ft. garage at 2470-78 North Clark St., for K. R. Beak, c/o architect. Estimated cost, $50,000.

Ill., Chicago—Newhouse & Burnham, Archts., 4630 Prairie Ave., are receiving bids for the construction of a 1 and 2 story, 140 x 308 ft. garage on Fair Oaks Ave. and Bway., for E. Bain and L. A. Wolf. Estimated cost, $80,000.

Ill., Chicago—C. D. Paschong, 6445 South Sangamon St., has awarded the contract for the construction of a 1 story, 110 x 150 ft. garage on Calumet Ave. and 63rd St. Estimated cost, $70,000.

Ind., Hammond—Jones & Laughlin Co., Ross St., Pittsburgh, Pa., plans to build a steel plant here. Probably private plans.

Ky., Louisville—The Haury Motor Co., 811 South 3rd St., has awarded the contract for the construction of a 2 story, 60 x 200 ft. garage on 3rd and York Sts. Estimated cost, $75,000. Noted Feb. 9.

Mass., Springfield—The Westinghouse Electric & Mfg. Co., Page Blvd., will build a 1 story, 80 x 520 ft. addition to its plant, for the manufacture of electric specialties. Estimated cost, $100,000.

Mass., Westfield—The Foster Machine Co., South Broad St., is having plans prepared for the construction of a 1 story, 25 x 120 ft. addition to its plant for the manufacture of textile machinery. Estimated cost, $35,000. Private plans.

Minn., Minneapolis—The Amer. Elevator & Warehouse Co., has purchased the plant of the Amer. Malt & Grain Co., on Childs St., here, and plans to build an addition. Estimated cost including equipment $50,000. C. E. Thayer, Pres.

N. H., Manchester—The Commonwealth Last Co., Somerville St., has awarded the contract for the construction of a 2 story, 91 x 160 ft. factory on Maple St., for the manufacture of shoe lasts. Estimated cost, $40,000.

N. J., Trenton—Fitzgibbon Crisp Co., Calhoun and Dunham Sts., has awarded the contract for the construction of a 1 story, 50 x 100 ft. factory for the manufacture of auto bodies. Estimated cost, $10,000.

N. Y., Oswego—The Fitzgibbons Boiler Co., 23 Mercer St., plans extension to plant. Estimated cost, between $40,000 and $50,000.

N. Y., Rochester—W. P. Farley, 1005 Harvard St., plans to build a machine factory on Halstead St. Estimated cost, $8,000. Architect not announced.

N. Y., Salamanca—C. R. Gibson plans to build a 2 story, 45 x 110 ft. garage on Wildwood Ave. Estimated cost, $40,000. Architect not announced.

O., Cleveland—J. Basta, 7001 Union Ave., has awarded the contract for the construction of a 1 story, 50 x 80 ft. garage at 11903 Miles Ave. Estimated cost, $40,000.

O., Cleveland—The Bd. Educ., East 6th St. and Rockwell Ave., will receive bids until May 15 for the construction of a 2 story, 65 x 245 ft. addition to high school on Scranton Rd. and Castle Ave., including manual training and workshop departments. Estimated cost, $400,000.

O., Cleveland—The Vichek Tool Co., 3000 East 87th St., has awarded the contract for the construction of a 1 story, 49 x 82 ft. heat treating plant on East 87th St. Estimated cost, $40,000.

Pa., Erie—Odin Stove Mfg. Co. plans to build a 26 x 122 ft. factory on West 12th St. for the manufacture of stoves. Estimated cost, $10,500. Architect not announced.

Pa., Kane—The E. & O. Mfg. Co., of Fredonia, N. Y., manufacturer of auto signal lamps, plans additions and alterations to former plant of Berry Truck & Body Co. here. Estimated cost between $15,000 and $20,000.

Pa., Koppel—The Koppel Car Repair Co. will build a 1 story, 60 x 500 ft. factory. Noted March 30.

Pa., Phila.—The White Dental Co., 211 South 12th St., has awarded the contract for the construction of a 1 story, 44 x 80 ft. factory on Oakland and Unity Sts. Estimated cost, $11,500.

Wis., Beloit—J. Terwillizer, Clinton, has awarded the contract for the construction of a 2 story, 75 x 135 ft. garage on Broad St. Estimated cost, $45,000. Noted April 27.

Wis., Cable—The Cable Auto Co. has awarded the contract for the construction of a 1 story 50 x 95 ft. garage on Main St. Estimated cost, $45,000.

Wis., Elkhorn—F. Hilton & Co. is having plans prepared for the construction of a 2 story, 42 x 60 ft. factory for the manufacture of band instruments. Estimated cost, $15,000. M. Tullgren & Sons, 425 East Water St., Milwaukee, Archts.

Wis., Kaukauna—W. Van Lieshout has awarded the contract for the construction of a 1 story, 50 x 100 ft. garage. Estimated cost $40,000.

Wis., Kenosha—Krisor Bros., 772 Milwaukee Ave., have awarded the contract for the construction of a 1 story, 60 x 110 ft. garage. Estimated cost, $40,000. Noted April 27.

Wis., Madison—The Madison Gas & Electric Co., 120 East Main St., is having plans prepared for the construction of a 2 story, 60 x 110 ft. service station and garage on Main St. Estimated cost, $45,000. J. St. John, Mgr. Private plans.

Wis., Madison—J. Peterson, 102 South Orchard St., is having plans prepared for the construction of a 1 story, 114 x 117 ft. garage on Monroe St. Estimated cost, $50,000. M. P. Schneider, 401 West Doty St., Archt. Wingra Park Garage Co., 1501 Monroe St., lessee.

Wis., Rosholt—J. Wisa, Polonia, plans to build a 1 and 2 story garage, here. Estimated cost, $40,000. Private plans.

Wis., Sturgeon Bay—Peterson Bros. Co. c/o G. Peterson, has purchased a site and plans to build a 2 story garage and repair shop. Estimated cost, $60,000. Architect not selected.

Ont., Welland—L. R. Weeks Eng. Co. is having plans prepared for the construction of a 1 story, 80 x 400 ft. plant for the manufacture of seamless steel tubing. Estimated cost, $100,000.

General Manufacturing

Cal., Fresno—The Fresno Bee has awarded the contract for the construction of a 3 story newspaper plant on Van Ness and Calaveras Sts. Estimated cost, $100,000.

Cal., San Francisco—O'Brien Bros., Inc., Archts., 240 Montgomery St., are receiving bids for the construction of a 2 story bakery on Howard St. near 4th St., for L. R. Lurie, Flatiron Bldg. Estimated cost, $10,000. Bake-Rite Oven Mfg. Co., Hearst Bldg., lessee.

Cal., Stockton—O. Kern, c/o Davis-Heller-Pearce Co., Delta Bldg., is having plans prepared for the construction of a 2 story, 75 x 100 ft. bakery and apartment building on California and Oak Sts. Estimated cost, $30,000.

Conn., New Britain—E. R. Hitchcock & Co., 303 Main St., has awarded the contract for the construction of a 2 story, 45 x 100 ft. printing plant on Chestnut St. Estimated cost between $35,000 and $40,000.

Conn., New London—The E. Bloom Co., Inc., has awarded the contract for the construction of a 2 story, 56 x 168 ft. addition to its silk factory on Elm St. Estimated cost, $50,000.

Ind., Hammond—The Standard Steel Car Co. has awarded the contract for the construction of a 1 story, 120 x 400 ft. paint shop. Estimated cost, $100,000.

Ky., Lexington—The Bybee Pottery Co., c/o T. B. McCoun, plans to build a pottery plant here. Cost to exceed $5,000. Architect not announced.

Me., Skowhegan—The Maine Spinning Co. has awarded the contract for the construction of a 3 story, 84 x 200 ft. spinning mill Estimated cost, $200,000. Noted March 16.

Mass., Lawrence—The Kress Carriage Co., 106 Concord St., will soon award the contract for the construction of a 2 story, 45 x 95 ft. addition to its carriage factory. Estimated cost, $35,000. Private plans.

Mass., North Dighton—The Mt. Hope Finishing Co. has awarded the contract for the construction of a 1 story 115 x 300 ft. main building; 1 story, 50 x 150 ft. soap house; 1 story, 50 x 150 ft. chemical laboratory; 1 story, 40 x 155 ft. dairy plant and 4 steel storage buildings. Estimated cost, $300,000. Noted April 13.

Mich., Detroit—A. Backus Junior & Sons, 1533 West Lafayette Ave., plans to build a 2 story box factory on Livernois Ave. along the track of the Detroit Terminal Railroad. Estimated cost, $200,000. Architect not selected.

Mich., Detroit—The Gunsberg Packing Co., 2380 20th St., having plans prepared for the construction of a 2 story addition to its sausage factory on 20th St. Estimated cost, $25,000. Kohner & Seeler, 1402 Kresge Bldg., Archts.

Mich., Detroit—H. Scherer, 440 East Jefferson Ave., manufacturers of auto trimmings and upholstering materials, has awarded the contract for the construction of a 10 story, 66 x 140 ft. shops and office building on Woodward Ave. Estimated cost, $75,000.

Mich., Kalamazoo—The City is having plans prepared for the construction of a gas plant. Estimated cost, $2,000,000. Burns & McDonnell, Interstate Bldg., Kansas City, Mo., Engrs.

N. Y., Allegany—The Acme Milling Co., Olean, plans to build a 2 story, 24 x 36 ft. and 1 story 36 x 38 ft. addition to its feed mill, here. Estimated cost, $10,000. Architect not announced.

N. Y., Buffalo—The DuPont Fibre Silk Co. has awarded the contract for the construction of an addition to its silk plant on River Rd. Estimated cost, $2,000,000. Noted April 13.

N. Y., Little Falls—The Barnett Leather Co., 81 Fulton St., New York, has awarded the contract for the construction of a factory, here. Estimated cost, $100,000.

N. Y., Lockport—G. F. Hardy, Engr., 309 Bway., New York City, is receiving bids for the construction of a paper mill here for A. W. Jack Corp. Estimated cost to exceed $100,000.

N. Y., New York—State Hospital Comm., Albany, has awarded the contract for the construction of a bakery building, etc., at the Manhattan State Hospital, Wards Island, here. Estimated cost, $240,000.

O., Barberton—The Silica Sand Co. plans to build a sand plant to replace the one recently destroyed by fire. Estimated cost, $25,000.

O., Cincinnati—Tietig & Lee, Archts., 901 4th Natl. Bank Bldg., will soon receive bids for the construction of a 5 story, 61 x 65 ft. cold storage plant on Cormany St., for the J. and F. Schroth Packing Co., Cormany and Township Sts. Estimated cost, $70,000.

O., Cleveland—The A. & B Box Co., 8628 Woodland Ave., has had plans prepared for the construction of a 1 story, 90 x 183 ft. factory on East 152nd St. Estimated cost, $60,000. H. C. Roberts, Secy. H. M. Morse & Co., Finance Bldg., Archts.

O., Cleveland—The Industrial Fibre Co., West 98th St., near Walford Rd., has had plans prepared for the construction of a 2 story, 41 x 99 ft. factory on West 98th St. Estimated cost, $50,000. J. H. Williams, c/o owner, Archt.

O., Cleveland—Rothkopf Bros., 6112 Central Ave., is having plans prepared for the construction of a 2 story, 40 x 130 ft. dairy at 10712 Superior Ave. Estimated cost, $75,000. A Sogg, 319 Hippodrome Bldg., Archt.

Pa., Erie—The Erie Burial Casket Co., 20th and Peach Sts., is having plans prepared for the construction of a 2 story, 200 x 300 ft. casket factory along the tracks of the Pennsylvania R.R. between 8th and 10th Sts. Estimated cost, $300,000. Private plans.

Pa., Pittsburgh—H. J. Heinz Co. has awarded the contract for the construction of a 6 story, 92 x 150 ft. spaghetti factory. Estimated cost, $250,000.

Pa., Phila.—Powers, Weightman-Rosengarten Co., 916 Parrish St., has awarded the contract for the construction of a 2 story, 42 x 80 ft. chemical plant on 35th and Moore Sts. Estimated cost, $20,000.

Pa., Pittsburgh—The St. Louis Independent Packing Co. has awarded the contract for the construction of a 2 story, 106 x 109 ft. cooler building at 6349 Station St. Estimated cost, $50,000. Noted April 27.

R. I., Olneyville—LePoutre Bros., c/o Lafayette Worsted Mills, Woonsocket, plan to build a large 2 story, spinning mill, here. Architect not announced.

Wis., Appleton—The Weber Knitting Mills, 624 Richmond St., plans to build a 2 and 3 story, 46 x 50 ft. knitting mill on Main St. Estimated cost, $50,000. Architect not announced.

Wis., Hartford—A. P. Janzer, (Palace Bakery), will build a 3 story, 30 x 70 ft. addition to bakery. Estimated cost, $10,000.

Wis., Lake Geneva—The Mann Candy Co., c/o F. Mann, Pres., has awarded the contract for the construction of a 2 story, 50 x 100 ft. ice cream factory. Estimated cost, $55,000.

Wis., Prairie du Chien—The Prairie du Chien Woolen Mill Co. will receive bids until May 20 for the construction of a 2 story, 47 x 187 ft. woolen mill. Estimated cost, $100,000. J. W. Paris, Secy. Parkinson & Dockendorff, Linker Bldg., LaCrosse, Archt.

Wis., Truesdale—The Truesdale Canning Co., 78 North Main St., Kenosha, is having preliminary plans prepared for the construction of a 2 story cannery. Estimated cost, between $50,000 and $60,000. E. Mischler, Pres. G. H. Leipold, 160 Martin St., Milwaukee, Archt.

Wis., Waukesha—O. W. Rowlands, Route 9, is receiving bids for the construction of a 1 story, 40 x 62 ft. pasteurizing plant near here. Estimated cost, $15,000. F. B. Gray, First Natl. Bank Bldg., Aurora, Ill., Archt.

Ont., St. Jacobs—The Snider Flour Milling Co. plans to rebuild flour mill which was partially destroyed by fire. Estimated cost, $100,000.

Special Opportunities

of many kinds in the machinery industry will be found in the

SEARCHLIGHT SECTION

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